SELECTED WATER RESOURCES ABSTRACTS

VOLUME 4, NUMBER 4
FEBRUARY 15, 1971

W71-01651 -- W71-02200

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WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

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As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on inside back cover.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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02 WATER CYCLE
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03 WATER SUPPLY AUGMENTATION AND CONSERVATION
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04 WATER QUANTITY MANAGEMENT AND CONTROL
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05 WATER QUALITY MANAGEMENT AND PROTECTION
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09 MANPOWER, GRANTS, AND FACILITIES
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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

01. NATURE OF WATER

1A. Properties

MODIFIED WATER BY THE CRYOSCOPIC METHOD.
B. V. Deryagin, B. V. Zheleznyi, N. N. Zakhavaeva, O. A. Kiseleva, and A. I. Konovalov.
Trans. from Doklady, An SSSR, Ser Khimiya, Vol. 189, No. 4, 5, 6, 1969. Available from NTIS as JPRS-499 86, $3.00 in paper copy, $0.95 in microfiche. JPRS (translation) 49986 March 5, 1970. 8 p, 9 ref.
Identifiers: *Water, Molecular weight, Cryostats, Anomalies, Melting, USSR, *Polywater.

Calculations have been made from cryoscopic methods to determine the modecular weight of polywater. Although an exact weight was not determined, the authors roughly calculated its molecular weight to be about 180.
W71-01669

ANAMALOUS WATER: DISCOVERY OR ERROR,
V. Zhvirblis.
Trans. from Khimiya: Zhizn, No. 12, p 37-44, 1969. Available from NTIS as JPRS-500 06, $3.00 in paper copy, $0.95 in microfiche. JPRS (translation) 500-06, March 6, 1970. 8 p.
Identifiers: *Water, Anomalies, Physical properties, Surface tension, USSR, *Polywater.

The report presents a discussion on what is known about anamalous water (Polywater)
W71-01670

ESTIMATION OF THE MOLECULAR WEIGHT OF THE ANOMALOUS COMPONENT OF MODIFIED WATER BY A CRYOSCOPIC METHOD,
Oak Ridge National Lab., Tenn.
B. V. Deryagin, B. V. Zheleznyi, N. N. Zakhavaeva, O. A. Kiseleva, and A. I. Konovalov.
Translated from Dokl. Akad. Nauk SSSR; 189: 1282-5 (1969). Available from NTIS as ORNL-tr-2301, $3.00 in paper copy, $0.95 in microfiche. ORNL-tr-2301, Mar 70. 9 p, 3 fig, 9 ref.
Identifiers: *Water, Weight, Anomalies, USSR, *Polywater.

Calculations were carried out to permit an estimation of the molecular weight of polywater. A value of approx. 180 was obtained for average molecular weight.
W71-01987

1B. Aqueous Solutions and Suspensions

ALKALINITY AND FORMATION OF ZEOLITES IN SALINE ALKALINE LAKES,
Wyoming Univ., Laramie. Dept. of Geology.
For primary bibliographic entry see Field 02H.
W71-01903

02. WATER CYCLE

2A. General

EFFECTS OF AREAL AND TIME DISTRIBUTION OF RAINFALL ON RUNOFF HYDROGRAPHS,
Minnesota Univ., Minneapolis. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 02E.
W71-01775

SIMULATION OF RIVER BED VARIATION IN MOUNTAINOUS BASIN,
Osaka Univ. (Japan). Dept. of Civil Engineering.
Akira Murota, and Michio Hashino.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 5-1 (Seminars), Science Council of Japan, Kyoto, p 245-248, 1969. 4 p, 8 fig, 1 ref.

Descriptors: *Sediment transport, *Provenance, *Sediment yield, *Simulation analysis, *Mathematical models, Erosion, Landslides, Rainfall-runoff relationships, Channel morphology, Stochastic processes, Hydrogeology.
Identifiers: Arita River (Japan).

A computer model for analytical calculation of river morphology accounts for the supply of debris products into the river channel. Rainfall is generated by a stochastic model and the resultant streamflows are anlayzed. When rainfall and water storage in the river basin increase so much that the water storage may cause landslides on mountainsides, debris supply is simulated by a stochastic debris-production model. The rainfall model consists of the frequencies of occurrence, interval, and intensity. The debris-production model is developed from a probability density distribution of debris prducts and a relation between total debris product and water storage, on the assumption of geological homogeneity of the river basin. Simulation is carried out to investigate river bed variation due to rainfall and debris production. Results of simulation are shown for one case of the bed profile after the 1953 disaster in the upper region of the Arita River, Japan. (Knapp-USGS)
W71-01782

ANALYTICAL SOLUTION OF WIENER-HOPF EQUATION FOR RUNOFF PREDICTION,
Tokyo Inst. of Tech. (Japan). Dept. of Civil Engineering.
Mikio Hino.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol I (Subject A), Science Council of Japan, Kyoto, p 519-524, 1969. 6 p, 2 fig, 9 ref.

Descriptors: *Rainfall-runoff relationships, *Stochastic processes, *Linear programming, Unit hydrographs, Mathematical models, Runoff forecasting, Streamflow forecasting, Optimization.
Identifiers: Wiener-Hopf equation.

The rainfall and runoff process may be considered to be a stationary stochastic process. It may be treated as a linear system, reducing the problem to an integral equation of the Wiener-Hopf type which relates the auto-covariance function of rainfall to the cross-covariance function of rainfall and runoff through the response function (the so-called unit hydrograph in a special case). The rainfall has a very random nature and consequently the auto-covariance of it is approximated simply by an exponential function. The cross-covariance of rainfall and runoff is expressed by the sum of a few terms of the product of exponential and power functions. The coefficients of weighting to be applied to each component are dependent on the ratios of the rainfall period to the periods of runoff components. The more rapidly a runoff component decreases, the lighter the weighting coefficient becomes. Some examples of application of the theory are shown. (Knapp-USGS)
W71-01807

WORLD METEOROLOGICAL ORGANIZATION AND ITS PROGRAMMES IN HYDROMETEOROLOGY AND HYDROLOGY,
World Meteorological Organization, Geneva (Switzerland). Hydrometeorology Div.
For primary bibliographic entry see Field 02B.
W71-01818

HYDROMETEOROLOGICAL STUDIES,
Weather Bureau, Silver Spring, Md. Office of Hydrology.
For primary bibliographic entry see Field 02B.
W71-01819

DIGITAL SIMULATION IN HYDROLOGY AND ITS ROLE IN HYDROLOGIC EDUCATION,
Stanford Univ., Calif. Dept. of Civil Engineering.
For primary bibliographic entry see Field 07C.
W71-01820

AN ENGINEERING-ORIENTED MODEL OF WATERSHED HYDROLOGY,
Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.
H. N. Holtan, and N. C. Lopez.
In: The Progress of Hydrology, Vol 2 - Specialized Hydrologic Subjects, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 572-604, published by Univ of Illinois, 1969. 33 p, 14 fig, 4 tab, 17 ref.

Descriptors: *International Hydrological Decade, Conferences, *Rainfall-runoff relationships, *Small watersheds, *Agricultural engineering, Water resources development, Forecasting, Hydrology, Hydraulics, Sedimentation, Soil conservation, Surface-groundwater relationships, Planning, Projects, Research facilities, Land development, Hydrogeology, Laboratories, Model studies, Technology, Computers, Instrumentation.
Identifiers: *Water resources research.

In the USDA Hydrograph Laboratory watershed hydrology is organized as a multidisciplinary approach with leadership in (1) meteorology and climate, (2) soils and vegetation, (3) hydraulics, (4) hydrogeology, and (5) watershed hydrologic systems. The mathematical model of watershed hydrology under study in the USDA Hydrograph Laboratory is dedicated to the purposes of agricultural watershed engineering. Major emphasis is on incrementation of the runoff process as prerequisite to watershed changes affecting chronological and spatial sequencing made for engineering purposes. Adistributed system of watershed hydrology is constructed to account for the development of dispersed waters and for their subsequent concentration in channel systems. (Knapp-USGS)
W71-01821

URBAN HYDROLOGY,
Bauer Engineering, Inc., Chicago, Ill.
For primary bibliographic entry see Field 04C.
W71-01822

A SUMMARY OF THE HOPKINS STORM DRAINAGE RESEARCH PROJECT: ITS OBJECTIVES, ITS ACCOMPLISHMENTS, AND ITS RELATION TO FUTURE PROBLEMS IN URBAN HYDROLOGY,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 04C.
W71-01823

SUBCRITICAL FLOW AT OPEN CHANNEL STRUCTURES - OPEN CHANNEL EXPANSIONS,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 08B.
W71-01836

TSUNAMI GENERATION,
Tetra Tech, Inc., Pasadena, Calif.
Li-San Hwang, and David Divoky.
Journal of Geophysical Research, Vol 75, No 33, p 6802-6817, November 20, 1970. 16 p, 7 fig, 1 tab, 19 ref. AEC Contract AT (26-1)-289 (006).

Descriptors: *Tsunamis, *Surface water, *Elevation, Mathematical studies, Equations, Earthquakes, Ocean waves, Wave pile-up, Seismic waves, Pacific Ocean.
Identifiers: *Tsunami generation, Ground motion, Elevation change, Seismic sea waves.

The problem of tsunami generation is treated by a numerical method utilizing the governing hydrodynamic equations of motion and continuity and a time-dependent description of bottom motion. The ground-motion model preserves the essential features of a real seismic event, including both horizontal rupture and vertical displacement with associated time scales. The vertical bottom displacement is coupled through the continuity equation to surface water elevation, and a finite difference scheme follows the development of the wave system. An example, the Alaskan Good Friday earthquake of 1964, is shown in some detail, and computations are compared with observations. The approach appears to be capable of accurate description of tsunami generation, limited only by uncertainties in tectonic input. It is also capable of accurate propagation calculations, limited by computer size. (Woodard-USGS)
W71-01908

THE WATER STRUCTURE UNDER A GROWING SEA ICE SHEET,
Bedford Inst., Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.
For primary bibliographic entry see Field 02C.
W71-01909

AN EVALUATION OF STREAMFLOW TIMING FROM SMALL WATERSHED IN NORTHEASTERN UNITED STATES,
Pennsylvania State Univ., University Park. School of Forest Resources; and Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 02E.
W71-01917

CALIBRATION ANALYSIS OF THE THREE LEADING RIDGE EXPERIMENTAL WATERSHEDS,
Pennsylvania State Univ., University Park. Dept. of Forestry and Wildlife.
For primary bibliographic entry see Field 02E.
W71-01918

2B. Precipitation

LARGE SCALE DYNAMIC EFFECTS OF CLOUD SEEDING,
Aerometric Research, Inc., Goleta, Calif.
For primary bibliographic entry see Field 03B.
W71-01672

WORLD METEOROLOGICAL ORGANIZATION AND ITS PROGRAMMES IN HYDROMETEOROLOGY AND HYDROLOGY,
World Meteorological Organization, Geneva (Switzerland). Hydrometeorology Div.
Jaromir Nemec.
In: The Progress of Hydrology, Vol 2-Specialized Hydrologic Subjects, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 512-520, published by Univ of Illinois, 1969. 9 p, 23 ref.

Descriptors: *International Hydrological Decade, Conferences, *Meteorology, *Rainfall-runoff relationships, Network design, Flood forecasting, Research and development, Water resources development, Forecasting, Hydrology, Hydraulics, Data collections, Data processing, Hydrologic data, Education, Research facilities, Exploration, Laboratories, Model studies, Technology, Computers.
Identifiers: *Water resources research, *World Meteorological Organization.

WMO's involvement in hydrology is fairly extensive and is concentrated on the operational aspects of surface water hydrology, including precipitation, snow cover, water level of lakes and streams, streamflow and storage, evaporation and evapotranspiration, soil moisture, relation of groundwater to surface water, water temperature, sediment discharge, river and lake ice, and chemical quality of water. In view of its experience in, and the close relationship between, meteorology and hydrology, the following fields are considered to be WMO's main responsibilities in hydrology: (a) the operational aspects of the collection, transmission, processing and publication of hydrological data; (b) research, development, improvement and promotion of methods, procedures and techniques in the design of networks, standardization of instruments and methods of observation, the operational phases of hydrological forecasting, and the supply of meteorological and related hydrological data for the design of projects. (Knapp-USGS)
W71-01818

HYDROMETEOROLOGICAL STUDIES,
Weather Bureau, Silver Spring, Md. Office of Hydrology.
John F. Miller.
In: The Progress of Hydrology, Vol 2 - Specialized Hydrologic Subjects, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 521-562, published by Univ. of Illinois, 1969. 42 p, 5 fig, 42 ref.

Descriptors: *International Hydrological Decade, Conferences, *Meteorology, *Design storm, *Probable maximum precipitation, Research and development, Water resources development, Forecasting, Synoptic analysis, Streamflow forecasting, Flood forecasting, Design flood, Hydrology, Mathematical models, Frequency analysis, Planning, Projects, Research facilities, Rainfall-runoff relationships, Model studies, Technology, Computers, Instrumentation.
Identifiers: *Water resources research.

For basins where streamflow data are not available or of insufficient length to provide adequate estimates of values for even the shorter return periods, it is necessary to develop substitute procedures. Such procedures can be a generalization or regional study of peak flows, frequency analysis of nearby streamflow data and adjustment to the point of interest, synthesis of frequency data based on precipitation-frequency studies, and or determination of the design flood based upon meteorological estimation of the Probable Maximum Precipitation (PMP). The historical development of design flood and PMP procedures and a brief summary of the techniques involved in these studies is discussed. (Knapp-USGS)
W71-01819

CONFIDENCE LIMITS FOR SEASONAL RAINFALL: THEIR VALUE IN KENYA AGRICULTURE,
East African Agriculture and Forestry Research Organization, Mugaga (Kenya).
T. Woodhead.
Experimental Agriculture, Vol 6, No 2, April 1970, p 81-86. 2 tab, 11 ref.

Descriptors: *Rainfall disposition, Rain gages, Water balance, Water requirements, Probable maximum precipitation, Economic feasibility, Farm management.
Identifiers: *Mugaga, Machakos, Kitale, Kenya, East African Meteorological Department.

In order to plan for the efficient use of land and water resources and to determine specific crop feasibilities, a prediction of rainfall in the area is a desirable factor to consider. In three different areas in Kenya a comparison was made between 20 day confidence limits (prediction) and actual rainfall. Although mathematical calculations, logarithmic transformation of skew rainfall data, were able to predict twenty-day rainfall totals, seasonal predictions were not as reliable. The author attempted to add together twenty day confidence limits to determine the seasonal rainfall expectation. However, it was found that rainfall variability is not as extreme during an actual season as it is during a twenty day period. (Holmes-Rutgers)
W71-02099

2C. Snow, Ice, and Frost

EVALUATION OF SOILS AND PERMAFROST CONDITIONS IN THE TERRITORY OF ALASKA BY MEANS OF AERIAL PHOTOGRAPHS, VOLUME I,
Purdue Univ., Lafayette, Ind., Engineering Experiment Station.
Robert E. Frost.
Available from NTIS as AD-703 359, $3.00 in paper copy, $0.95 in microfiche. September 1950. 50 p, 94 fig.
Identifiers: *Terrain, Aerial reconnaissance, *Construction, Alaska, *Soils, Permafrost, Aerial photographs, Landing fields, Seacoast, Drainage, Erosion, Photointerpretation, Rivers, Plants (Botany), Colors, Rock (Geology), Ice, Photographic tone, Trafficability, Site selection, Cold weather construction, and forms, Remote areas.

The report presents the results of one phase of the investigation of airfield construction in arctic and subarctic regions being conducted by the St. Paul District, Corps of Engineers, Department of the Army. The overall investigation has as its objective the determination of design criteria and construction methods for areas of permanently frozen ground. The objective of this phase of the investigation has been the development of a technique whereby engineering soils and permafrost conditions could be evaluated from aerial photographs. (See also W71-01666)
W71-01665

EVALUATION OF SOILS AND PERMAFROST CONDITIONS IN THE TERRITORY OF ALASKA BY MEANS OF AERIAL PHOTOGRAPHS, VOLUME II.
Purdue Univ., Lafayette, Ind., Engineering Experiment Station.

Available from NTIS as AD-703 343, $3.00 in paper copy, $0.95 in microfiche. September 1950. 112 p, 98 fig, 207 ref.
Identifiers: *Terrain, Aerial reconnaissance, *Construction, Alaska, *Soils, Permafrost, *Aerial photography, Terrain, Site selection, Deposits, Floods, Seacoast, Rivers, Drainage, Colors, Plants, Botanay, Photointerpretation, Silt, Glaciers, Rock, Geology, Ice, Maps, Cold weather construction, Land forms, Remote areas, Flood plains, Tundra, Levees.

Water-deposited materials in Alaska are important for engineering uses because of their general flat topographic situation and abundance. For the purposes of this study, the airphoto patterns of water deposited materials are divided on the basis of origin as follows: coastal plain; stream-deposited materials in the form of flood plains and terraces; and deltas. There are several other water-deposited types such as lacustrine, valley fill, and the several outwash groups. Outwash materials are discussed in the chapter on glacial patterns since complete knowledge of the pattern and its suggested features frequently depend on an analysis of glacial events. Successful interpretation of conditions of various water-deposited materials is contingent on the treatment of each topographic situation as an entire and separate unit. (See also W71-01665)
W71-01666

PHENOMENON AND MECHANISM OF FROST HEAVING,
Cold Regions Research and Engineering Lab., Hanover, N.H.
For primary bibliographic entry see Field 08D.
W71-01726

SNOW AND ICE HYDROLOGY,
Colorado State Univ., Fort Collins. Dept. of Watershed Management.
Walter U. Garstka.

In: The Progress of Hydrology, Vol 2 - Specialized Hydrologic Subjects, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 717-728, published by Univ of Illinois, 1969. 12 p, 26 ref.

Descriptors: *International Hydrological Decade, Conferences, *Education, *Snow, *Ice, Research and development, Snowpacks, Snowfall, Glaciers, Freezing, Thawing, Water resources development, Forecasting, Hydrology, Hydraulics, Snow management, Snow surveys, Projects, Research facilities, Model studies, Instrumentation.
Identifiers: *Water resources research, Snow and ice hydrology.

Teaching of the hydrology of snow requires a true interdisciplinary approach since it is based upon a background of meteorology, climatology, thermodynamics, soil physics, forestry, hydrology, and mathematics, including computer technology. The teaching of snow and ice hydrology may be performed at various educational levels. At any level of education the subject must be presented in such a way that it is integrated with the general field of hydrology and water resources development as one of the most important parts of man's responsibility for maintaining and improving the environment. (Knapp-USGS)
W71-01826

GLACIERS AND SNOWPACKS: SOME COMMON PROBLEMS IN NON-POLAR GLACIOLOGY,
Geological Survey, Tacoma, Wash.
Mark F. Meier.
In: The Progress of Hydrology, Vol 2 - Specialized Hydrologic Subjects, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 729-736, published by Univ of Illinois, 1969. 8 p.

Descriptors: *International Hydrological Decade, Conferences, *Glaciers, *Snowpacks, *Water resources development, Research and development, Forecasting, Hydrology, Hydraulics, Education, Planning, Projects, Research facilities, Exploration, Laboratories, Model studies, Technology, Computers, Instrumentation.
Identifiers: *Water resources research, *Glaciology.

The general field of glacier hydrology is briefly introduced with special reference to the effect of glaciers on water supply in temperate and subpolar latitutdes. Problems and new approaches common to both the study of temperate latitutde glaciers and to the economically more important problem of forecasting water supply from the seasonal snow cover are discussed. There is no basic difference between the objectives and kinds of research being done by snow hydrologists and by those who study glaciers. Some implications of these research needs to hydrologic education are also discussed. Glaciers are a water resource of major proportions. About three-fourths of all the fresh water in the world, equivalent to about 60 years of precipitation over the entire globe, is temporarily stored as glacier ice. Glaciers cover about 11% of the world's land surface. Although small by polar standards, glacier ice in more temperate regions is an important resource. In North America the volume of water stored as snow and ice in glaciers is far larger than that stored in all the lakes, ponds, rivers, and reservoirs on the continent. (Knapp-USGS)
W71-01827

THE WATER STRUCTURE UNDER A GROWING SEA ICE SHEET,
Bedford Inst., Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.
E. L. Lewis, and E. R. Walker.
Journal of Geophysical Research, Vol 75, No 33, p 6836-6845, November 20, 1970. 10 p, 9 fig, 13 ref.

Descriptors: *Water structure, *Ice-water interfaces, *Oceans, Saline water, Sea ice, Water temperature, Latent heat, Density, Model studies, Profiles, Thermal properties, Thermocline, Thermometers.
Identifiers: *Cambridge Bay (Canadian Northwest), Thermistor.

Data illustrating seasonal changes in temperature and salinity profile beneath an annual sea ice cover at Cambridge Bay, Canadian Northwest Territories, are presented. The water column heat loss is about 15% of the latent heat extracted for ice growth. Time series temperatures (measured over one month with a thermistor chain depending from the ice sheet) indicate penetrative convective plumes as a probable mechanism for profile changes and are tentatively related to laboratory studies. (Woodard-USGS)
W71-01909

2D. Evaporation and Transpiration

PART I, CONTROLLING THE SOIL MOISTURE ENVIRONMENT OF TRANSPIRING PLANTS, PART II, PREDICTION OF LEAF TEMPERATURE UNDER NATURAL ATMOSPHERIC CONDITIONS,
Kentucky Water Resources Inst., Lexington.
For primary bibliographic entry see Field 02I.
W71-01660

MICROCLIMATE BEFORE AND AFTER IRRIGATION,
Washington Univ., Seattle. Coll. of Forest Resources.
For primary bibliographic entry see Field 02I.
W71-01720

SIGNIFICANCE OF EVAPORATION IN HYDROLOGIC EDUCATION,
Illinois State Water Survey, Urbana.
W. J. Roberts.
In: The Progress of Hydrology, Vol 2 - Specialized Hydrologic Subjects, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 666-693, published by Univ of Illinois, 1969. 28 p, 8 fig, 26 ref.

Descriptors: *International Hydrological Decade, Conferences, *Evaporation, *Education, Research and development, Water supply, Mathematical models, Water balance, Hydrologic budget, Water resources development, Hydrology, Hydraulics, Mass transfer, Energy budget, Planning, Research facilities, Economics, Technology, Computers, Instrumentation.
Identifiers: *Water resources research.

Because evaporation is the second largest factor in the hydrologic cycle there is great need for accurate evaporation data for water resource planning. Surface water sources that rely upon streamflow should be designed to withstand dry weather conditions when evaporation is at a maximum and streamflow is at a minimum. In flat prairie, such as Illinois, the average depth of water supply reservoirs is only 10 feet, and in most of these one-half of the reservoir capacity is stored in the top 3 feet of water. Normal annual evaporation is close to 3 feet; it is obvious that most reservoirs would fail in draughts if evaporation is not considered in the plans. Nearly 500 station-years of record have been collected from evaporation pans located throughtout the country. Evaporation calculations by water budget, energy budget, and mass transfer methods are described. Recent work on evaporation control is briefly reviewed. (Knapp-USGS)
W71-01824

EVAPOTRANSPIRATION A FACTOR IN THE PLANT-SOIL WATER ECONOMY,
Agricultural Research Service, Coshocton, Ohio. Soil and Water Conservation Research Div.
Lloyd L. Harrold.
In: The Progress of Hydrology, Vol 2 - Specialized Hydrologic Subjects, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 694-716, published by Univ of Illinois, 1969. 23 p, 2 fig, 22 ref.

Descriptors: *International Hydrological Decade, *Evapotranspiration, Education, Conferences, *Water resources development, Research and development, Forecasting, Hydrology, Land management, Water conservation, Water yield improvement, Planning, Projects, Research facilities, Soil-water-plant relationships, Reviews, Laboratories, Model studies, Technology, Computers, Instrumentation.
Identifiers: *Water resources research.

Evapotranspiration is an important factor in the hydrologic cycle. It accounts for disposal of nearly 100 percent of the year's precipitation in arid lands and about 75 percent in humid regions. Wherever it goes through the food-fiber plant mechanism it is considered productive. In many places it is unproductive, except to recharge the atmospheric phase of the hydrologic cycle. Adjustments in land and water management can improve the efficiency of water use in food-fiber production. Mathematical watershed performance models are being developed for predicting runoff from the functioning of important parts of an entire flow system. ET prediction in this model greatly influences the results. Reference is made to a number of modern techniques for estimating potential evapotranspiration (PET) and for modifying these estimates to evaluate ET. The use of various types of lysimeters for measuring ET is discussed. (Knapp-USGS)
W71-01825

MICROMETEOROLOGICAL INVESTIGATIONS OF THE ENERGY BUDGET: EFFECT OF SUMMER WINDS,
Kansas Water Resources Research Inst., Manhattan.
E. L. Skidmore, H. S. Jacobs, L. J. Hagen, and W. L. Powers.
Available from NTIS as PB-195 927, $3.00 in paper copy, $0.95 in microfiche. Project Completion Report, October 1970. 61 p, 2 tab, 20 fig, 4 ref. OWRR Project No. A-005-KAN (1).

Descriptors: *Evaporation, *Evapotranspiration, *Wind, Energy budget, Atmometers, Micrometeorology, Humidity, Shelterbelts.
Identifiers: *Barriers, *Windbreaks, *Shelter, *Potential evaporation, Microclimate, Air temperature, Bowen ratio, Solar radiation, Net radiation, Aerial environment, Slat-fence, Great Plains.

Summer wind enhances potential evapotranspiration in the Great Plains by a large but predictable amount. This high potential evaporation can be reduced by lowering windspeeds with windbreaks or barriers. Windbreaks reduce evaporation rates from a wet surface proportionably to windspeed reduction with a proportionality constant usually less than 0.5. Use of windbreaks for reducing windspeed causes other changes in the microclimate. The highest humidity and humidity gradients, highest daytime air temperature, lowest nighttime air temperature, and generally the steepest temperature gradients all occurred in the ares where the windbreak reduced windspeed to the lowest level. The absolute humidity was lower at 12 times the windbrea's height leeward than in the open field. These findings indicate that windbreaks lower the evaporative demand and induce a more favorable environment for plant growth in the harsh climate of the Great Plains. However, additional research is needed to evaluate plant response and actual evaporation as influenced by barrier induced microclimate. (McKenna-Kansas State)
W71-01889

CONSUMPTIVE USE OF WATER BY SUGARCANE IN HAWAII,
Hawaii Univ., Honolulu. Water Resources Research Center.

Paul C. Ekern.
Available from NTIS as PB-195 978, $3.00 in paper copy, $0.95 in microfiche. Hawaii University Water Resources Research Center Technical Report No 37, July 1970. 93 p, 35 fig, 16 tab, 49 ref, 5 append. OWRR Project A-014-HI (1).

Descriptors: *Evapotranspiration, *Sugarcane, *Hawaii, Lysimeters, Irrigation, Percolation, Climatology, Soil moisture, Solar radiation, Evaporation pans, Rainfall, Chemical analysis, Water chlorides, Nitrates, Sulfates, Silica, Meteorological data, Hydrologic data.
Identifiers: Laboratory desorption curve.

Water use by sprinkler irrigated sugarcane under flat-bed culture was measured in four 100 sq ft by 5 ft deep hydraulically weighed lysimeters at the Kunia substation of the Hawaiian Sugar Planters' Association. Nine-week-old one-eye cane transplants were set into a 5-foot grid in Molokai Low Humic Latosol on October 27, 1968. Water use approached a 1:1 ratio with a conventional class A pan by late March 1969 for a 3.5 leaf area index. Average values were 0.25 in/day for the midsummer months. The cane was ratooned on May 10, 1969 and water use was reduced to a 0.33 fraction of pan evaporation. The cane regrew rapidly and water use was again equivalent to pan evaporation. The cane regrew rapidly and water use was again equivalent to pan evaporation by July 1969. Consumptive use by cane or pan often equalled or exceeded the net radiation, indicating strong positive advection of heat from the surroundings. During the early stages of cane growth, percolate from heavy winter rains contained as great as 225 ppm nitrate, but as the cane matured, the percolate had less than 1 ppm nitrate though the content of other solutes such as chloride, sulfate, and silica remained high. (Woodard-USGS)
W71-01902

2E. Streamflow and Runoff

AN ECONOMIC REAPPRAISAL OF THE TOLEDO BEND MULTIPLE-PURPOSE PROJECT,
Louisiana Water Resources Research Inst., Baton Rouge.
For primary bibliographic entry see Field 06B.
W71-01652

A MULTIVARIATE STATISTICAL MODEL FOR ESTIMATING THE NUMBERS, SIZES,AND INTERFLUVIAL DISTANCES OF STREAMS WITHIN A RELATIVELY HOMOGENEOUS DRAINAGE AREA.
Naval Postgraduate School, Monterey, Calif.

Available from NTIS as AD-706 058, $3.00 in paper copy, $0.95 in microfiche. MS Thesis, October 1969. 80 p, 10 tab, 12 fig, 36 ref.
Identifiers: *Terrain, Rivers, *Rivers, Mathematical prediction, Hydrology, Mathematical models, Multivariate analysis, Probability density functions, Theses, Geomorphology, *Streams, *Watersheds.

A model has been developed for estimating the number, sizes, and interfluvial distances of streams to be crossed in traversing a naturally occurring drainage basin. A relationship among four network parameters has been found which, upon quantification, provide sufficient information to completely structure a mature drainage system. The four parameters are: stream length ratio, basin shape parameter, and coefficient of drainage density. The model is amendable to computer solution. Procedures are described for parameter quantification using common topographic maps.
W71-01662

BOEHM V WERMUTH (DIVERSION OF STREAM FROM LANDOWNER'S PROPERTY).
For primary bibliographic entry see Field 06E.
W71-01677

ELLERSON FLORAL CO V CHESAPEAKE AND O RY (LIABILITY FOR FLOODING CAUSED BY EXTRAORDINARY RAINFALL).
For primary bibliographic entry see Field 06E.
W71-01770

FLOOD PLAIN INFORMATION, TUSCARAWAS RIVER, STARK COUNTY, OHIO.
Corps of Engineers, Huntington, W. Va.
For primary bibliographic entry see Field 04A.
W71-01773

FLOOD PLAIN INFORMATION, EAST FORK STONES RIVER, WOODBURY, TENNESSEE.
Corps of Engineers, Nashville, Tenn.
For primary bibliographic entry see Field 04A.
W71-01774

EFFECTS OF AREAL AND TIME DISTRIBUTION OF RAINFALL ON RUNOFF HYDROGRAPHS,
Minnesota Univ., Minneapolis. Dept. of Agricultural Engineering.
Tsong Chang Wei.
Ph. D. Thesis, Minnesota University, August 1970. 218 p, 31 fig, 28 tab, 71 ref, 2 append. OWRR Project A-017-MINN (1).

Descriptors: *Rainfall-runoff relationships, *Mathematical models, *Parametric hydrology, *Routing, Model studies, Runoff forecasting, Hydrographs, Hydrograph analysis, Prescipitation excess, Time lag, Synthetic hydrology.
Identifiers: Kinematic wave theory, Hydrograph synthesis.

A mathematical watershed model of 1.456 square miles was developed to route runoff through overland flow and through the channel system. Excess rainfall was used as input data and the flow was routed by the successive numerical solution of the kinematic wave equations to produce outflow hydrographs for elementary (first order) watersheds. These hydrographs were used as input to the channel system where the flow was routed by the successive numerical solution of the dynamic wave equations to yield the outflow hydrograph for the model watershed. The model was used to study the effects of time distribution and areal distribution of rainfall, storm movement and watershed shape on the runoff hydrograph. In general, the selected time, areal, storm movement and watershed shape factors have significant effects on peak discharge. These effects are listed and described. (Knapp-USGS)
W71-01775

SOME MORPHOMETRICAL RELATIONSHIPS IN THE MIDDLE AND LOWER REACHES OF THE AMU DARYA,
Sredneazuatsjuu Bauchno-Issledovatelskii Institut Irrigatsii, Tashkent (USSR).
For primary bibliographic entry see Field 08B.
W71-01779

MORPHOLOGICAL PRINCIPLE OF MODELLING RIVER-BED PROCESS,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 08B.
W71-01780

ON THE MEAN VELOCITY FORMULAS OF RIVERS,
Tokushima Univ. (Japan). Dept. of Civil Engineering.
Sutesaburo Sugio.
In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 5-1 (Seminars), Science Council of Japan, Kyoto, p 257-260, 1969. 4 p, 3 fig.

Descriptors: *Sediment transport, *Regime, Channel morphology, Velocity, Streamflow, Sediment yield, Bed load, Dunes, Sand waves.
Identifiers: Streamflow velocity.

There are three typical groups of mean velocity formulas for alluvial streams described by Lacey's and Simons' concept that mean velocity is a function of the square hydraulic mean depth and river slope. The bed form for each group seems to correspond to ripples, dunes, and upper regimes, and a criterion chart is given for rough estimation of velocity. (Knapp-USGS)
W71-01784

COMPUTATION OF DOMINANT DISCHARGE,
Gifu Univ. (Japan). Dept. of Civil Engineering.
Saburo Komura.
In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 5-1 (Seminars), Science Council of Japan, Kyoto, p 265-268, 1969. 4 p, 1 tab, 2 ref.

Descriptors: *Discharge (Water), *Streamflow, *Sediment transport, *Theoretical analysis, Mathematical studies, Equations, Computers, Sediment load, Bed load, Flow rates, Streambeds, Sediment distribution, Foreign projects.
Identifiers: *Dominant discharge (Water), *Japan.

Stream discharge and sediment transport parameters are used to formulate equations for computing dominant discharge. The dominant discharge can be computed from an equation by using mean daily water discharges and a relevant exponent value. The dominant discharge below the confluence is larger than the sum of the dominant discharges entering the confluence. (Woodard-USGS)
W71-01787

DIGITAL COMPUTER CALCULATION OF UNSTEADY OPEN-CHANNEL FLOW (FRENCH),
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
For primary bibliographic entry see Field 08B.
W71-01800

ON THE SIMULATION OF RIVER-BED VARIATION BY CHARACTERISTICS,
Public Works Research Inst., Tokyo (Japan).
For primary bibliographic entry see Field 08B.
W71-01801

SIMULATION OF FLOOD PROPAGATION BY DIGITAL COMPUTER AND ITS APPLICATION TO RIVER PROBLEM,
Central Research Inst. of Electric Power Industry, Tokyo, (Japan).
For primary bibliographic entry see Field 08B.
W71-01802

LAMINAR FLOW IN OPEN RECTANGULAR CHANNELS (A CONTRIBUTION TO THE FLOW PROBLEM OF OPEN CHANNELS),
For primary bibliographic entry see Field 08B.
W71-01803

SIMILITUDE OF MOBILE BED MODELS AND THE EFFECTS OF VARIATIONS ON THE LAWS OF SIMILITUDE (FRENCH),
Robert College, Istanbul (Turkey). Dept. of Hydraulics.
For primary bibliographic entry see Field 08B.
W71-01804

DETERMINATION OF COEFFICIENTS OF HYDRAULIC LOSS FOR UNSTEADY OPEN CHANNEL FLOW (FRENCH),
Technische Universitaet, Dresden (East Germany).
For primary bibliographic entry see Field 08B.
W71-01805

SIMULATION OF THE BAVARIAN REACH OF THE DANUBE RIVER,
Technische Hochschule, Munich (West Germany).
For primary bibliographic entry see Field 08B.
W71-01806

ANALYTICAL SOLUTION OF WIENER-HOPF EQUATION FOR RUNOFF PREDICTION,
Tokyo Inst. of Tech. (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02A.
W71-01807

A FRAMEWORK FOR EVALUATING CARBONATE HYDROLOGY,
Geological Survey, Raleigh, N.C.
Harry E. LeGrand.
In: The Progress of Hydrology, Vol 2 - Specialized Hydrologic Subjects, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 887-913, published by Univ of Illinois, 1969. 27 p, 29 ref.

Descriptors: *International Hydrological Decade, Conferences, *Hydrogeology, *Carbonate rocks, Reviews, Research and development, Karst, Groundwater movement, Water resources development, Forecasting, Hydrology, Hydraulics, Laboratories, Model studies, Technology.
Identifiers: *Water resources research.

The status of hydrology of carbonate-rock aquifer systems is reviewed. In many discussions of groundwater hydrology, carbonate terranes are often considered a qualified addendum or a special aspect. In contrast to almost all other types of rocks, limestones and other carbonates may have hydrologic conditions that appear to be self-engendered. For example, where other factors are not restrictive, circulation of water leads to solution of the rocks and, in turn, solution favors greater circulation. If specific studies and principles could be synthesized and could be brought together properly a better and quicker understanding of carbonate hydrology would be available. A few brief statements of some pertinent principles are presented to help get a useful perspective. (Knapp-USGS)
W71-01834

A SHORT HISTORY OF HYDROLOGY,
Dept. of Energy, Mines and Resources, Ottawa (Ontario). Resources Research Center.
For primary bibliographic entry see Field 02F.
W71-01835

SUBCRITICAL FLOW AT OPEN CHANNEL STRUCTURES - OPEN CHANNEL EXPANSIONS,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 08B.
W71-01836

MEAN ANNUAL RUNOFF AS RELATED TO CHANNEL GEOMETRY OF SELECTED STREAMS IN CALIFORNIA,
Geological Survey, Washington, D.C.
E. R. Hedman.
Geological Survey Water-Supply Paper 1999-E, 1970. 17 p, 10 fig, 2 tab.

Descriptors: *Streamflow, *Average flow, Annual, *Channel morphology, *California, Perennial streams, Ephemeral streams, Runoff, Hydrologic data, Streams, Flow rates, Gaging stations, Discharge (Water).
Identifiers: Computations, Channel geometry.

The channel geometry of 48 gaged streams in California where mean annual runoff is known was studied in 1967 and 1968. The analyses show that the mean annual runoff is related to selected dimensions of channel geometry. The width and the average depth of the cross section between bars or berms can be used to estimate annual runoff from ungaged streams. Separate relations are needed for perennial and ephemeral streams. The analyses also showed that it is better to measure several cross sections, compute the discharge for each cross section, and average these discharges to obtain the discharge for the site. A 10-year period, 1958-67, was analyzed to determine if the channel dimensions were affected by recent hydrologic or climatic events. It was determined that the computed runoff represented a long-term mean' that is, the standard error of estimate was less for the regression using the runoff for the period of record rather than for the 10-year period. (Woodard-USGS)
W71-01906

A PROCEDURE FOR COMPUTING AND DISPLAYING TIME VARYING POWER SPECTRA ILLUSTRATED BY APPLICATION TO A GEOPHYSICAL PROCESS,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
For primary bibliographic entry see Field 07C.
W71-01910

PRELIMINARY REPORT ON THE WATER RESOURCES OF NORTHEAST MAUI,
Geological Survey, Honolulu, Hawaii.
K. J. Takasaki, and George Yamanaga.
Hawaii Division of Water and Land Development Circular C60, Ausust 1970. 41 p, 10 fig, 6 tab, 8 ref.

Descriptors: *Water resources, *Hawaii, *Hydrologic cycle, Surface waters, Groundwater, Rainfall, Runoff, Streamflow, Flow rates, Aquifers, Permeability, Aquifer characteristics, Artesian wells, Discharge (Water), Water table.
Identifiers: *Noretheast Maui (Hawaii), Well logs.

Northeast Maui, as described in this report, includes about 165 square miles of the northeast and east slopes of Haleakala. Large forest reserves, on lands too wet for cultivation or at altitudes too high for development, make up much of the area. The lower, drier slopes are used mainly for grazing, and smaller areas for orchards and taro cultivation. Population in 1969 was less than 1,500. The hydrology and geology, as outlined, is based on published and unpublished reports of findings of previous investigators, and on records of stream and ditch flows published by the U. S. Geological Survey. It describes in general, the occurrence of water and some of the geologic features that control its movement and availability. It also summarizes and updates information available on groundwater and on stream and ditch flows. Tables of data include chemical quality analyses, stream discharge rates, and well records. (Woodard-USGS)
W71-01911

WATER RESOURCES INVENTORY OF CONNECTICUT - PART 4. SOUTHWESTERN COASTAL RIVER BASINS,
Geological Survey, Hartford, Conn.
Robert B. Ryder, Michael A. Cervione, Jr., Chester E. Thomas, Jr., and Mendall P. Thomas.
Connecticut Water Resources Bulletin No 17, 1970. 54 p, 33 fig, 3 plate, 19 tab, 57 ref.

Descriptors: *Water resources, *Connecticut, *Surface waters, *Groundwater, Precipitation (Atmospheric), Runoff, Streamflow, Reservoirs, Estuaries, Hydrologic data, Water quality, Temperature, Water supply.
Identifiers: Southwestern coastal river basins (Conn).

Information and data concerning water resources of 440 square miles of the southwestern coastal river basins (394 square miles of which are in Connecticut) are presented. Maps, graphs, figures, and tables of data relate precipitation, streamflow, reservoirs, estuaries, groundwater, temperature and water quality. Much of the water in the basins is of good to excellent chemical quality and contains a low concentration of dissolved solids. However, the quality of water in many streams, flowing through urban areas is impaired by man's activity. Also, the quality of groundwater in localized areas is affected by domestic and industrial wastes, road-salting chemicals, and by salt water from estuaries and Long Island Sound. The total amount of water used in the basins in 1965 was about 36.7 billion gallons or about 165 gpd per capita; 87% of the total was supplied by water utilities. The water-utility systems are supplied by many reservoirs, several in the same drainage basin. (Woodard-USGS)
W71-01912

STREAM DISPERSION AT SELECTED SITES,
Geological Survey, Washington, D.C.
Richard G. Godfrey, and Bernard J. Frederick.
For sale by Superintendent of Documents, U S Government Printing Office, Washington, D. C. 20402 - Price $0.55. Geological Survey Professional Paper 433-K, 1970. 38 p, 6 fig, 15 tab, 11 ref.

Descriptors: *Dispersion, *Tracers, *Streams, Testing, California, Tennessee, Virginia, Streamflow, Channels, Canals, Flow rates, Diffusion, Time, Turbulence, Analysis, Theoretical analysis, Model studies.
Identifiers: *Radiotracer (Gold-198).

Tests were conducted by the U. S. Geological Survey, in cooperation with the U. S. Atomic Energy Commission in California, Tennessee, and Virginia to study the dispersion patterns of a radiotracer in five natural stream channels and in one canal. The radiotracer, gold-198, was injected as a line source. The patterns of dispersion that were observed in these channels were compared with patterns predicted by the theoretical model for one-dimensional flow developed by G. I. Taylor (1954). Analysis of the relation between time and concentration of the tracer at several sections in each of the six reaches shows that his theoretical model is not adequate to describe the dispersion patterns actually observed. Dispersion coefficients determined from the test data, though constant as theoretically predicted, are about 4 to 35 times greater than those predicted by Taylor. (Woodard-USGS)
W71-01914

AN EVALUATION OF STREAMFLOW TIMING FROM SMALL WATERSHED IN NORTHEASTERN UNITED STATES,
Pennsylvania State Univ., University Park. School of Forest Resources; and Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station.
William E. Soper, and Howard W. Lull.
Proceedings Paper from 14th International Union Forestry Research Organizations Conference, Munich, Germany, September 1967, p 281-297, 1967. 17 p, 1 fig, 5 tab, 11 ref. OWRR Project No A-006-PA (7).

Descriptors: *Rainfall-runoff relationships, *Watershed management, Depth-area-duration analysis, *Base flow, *Peak discharge, Flow rates, Timing, Discharge (Water), Streamflow, Gaging stations, Topography, Slopes, Precipitation (Atmospheric), Climatic zones, Vegetation effects, Runoff coefficient, Mathematical studies.
Identifiers: *New England and bordering States.

Daily streamflow records for a 17-year period from 134 small watersheds, less than 100 square miles in area, were utilized to evaluate streamflow timing in northeastern United States. Criteria used to characterize streamflow timing were high-flow and low-flow intervals. Maps, tables of data, and interpretations of results of the study are included. In summary, latitude, mean maximum January temperature, elevation, relief, and forest cover percentage are the variables most highly correlated with high-flow intervals and beginning dates. A greater number of days were required to produce 1 and 5 percent of annual flow in the northern re-

gions than in the southern. Latitude, mean maximum July temperature, elevation, and forest cover percentage were variables most highly correlated with low-flow intervals. (Woodard-USGS)
W71-01917

CALIBRATION ANALYSIS OF THE THREE LEADING RIDGE EXPERIMENTAL WATERSHEDS,
Pennsylvania State Univ., University Park. Dept. of Forestry and Wildlife.
Thomas H. Yorke, Jr.
M. S. Thesis, Pennsylvania State University Institute for Research on Land and Water Resources, September 1967. 76 p, 13 fig, 20 tab, 30 ref, append. OWRR Project No A-006-PA (10).

Descriptors: *Watershed management, *Rainfall-runoff relationships, *Erosion control, *Water yield, *Forestry, Forest management, Sedimentation, Base flow, Depth-area-duration analysis, Depth-area curves, Floods, Infiltration, Overland flow, Pennsylvania, Topography, Vegetation effects.
Identifiers: *Calibration analysis, *Experimental watersheds.

To determine relationships between water regimens of 6 experimental watersheds in the Stone Valley Experimental Forest, Pennsylvania, to serve as a datum for estimating runoff after various forest treatments have been applied, 6 years of rainfall and runoff records were collected and analyzed. Calibrations were made of 3 watersheds in the Leading Ridge Unit to determine the water-yield regimens. Highest correlations exist between the annual flow of Watersheds One and Three and Watershed Two and Three where the coefficients were 0.999 and 0.997. Watershed Two is the best control for low flow conditions. Increases of 1.5 area-inches on Watershed One and 1.7 area-inches on Watershed Three during the first growing season after treatment will be significant. Increases of 2.1 and 1.4 area-inches respectively on Watersheds One and Two during the first dormat season will be statistically significant. In conclusion, Watershed Two is the most suitable to leave in natural state as the control for watershed treatment experiments. (Lang-USGS)
W71-01918

ON THE SHORELINE AND LEADING FRONT CONDITIONS OF TSUNAMI WAVES IN THE LIGHT OF THE METHOD OF CHARACTERISTICS,
Tohoku Univ., Sendai (Japan). Dept. of Civil Engineering.
Toshio Iwasaki, and Hiroyoshi Togashi.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 501-508, 1969. 8 p, 5 fig, 12 ref.

Descriptors: *Tsunamis, *Shores, *Tidal effects, *Bores, Theoretical analysis, Coasts, Sea walls, Beaches, Equations.

A tsunami wave approaching a sloping beach has a bore front even if the surface slope is horizontal. The bore height decreases as it approaches the shoreline and ultimately disappears to become simply a positive disturbance. Shoreline conditions and overflow at the composite type beach where a vertical quaywall is located on a sloping beach is treated for a nonbreaking tsunami. Shoreline and front conditions are investigated theoretically. (Woodard-USGS)
W71-01940

MODELING FEEDLOT RUNOFF POLLUTION,
Kansas State Univ., Manhattan. Dept. of Chemical Engineering; and Kansas State Univ., Manhattan. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05B.
W71-02040

DESIGN OF A HYDROLOGIC CONDITION SURVEY USING FACTOR ANALYSIS.
For primary bibliographic entry see Field 04D.
W71-02085

BENNETT V CUPINA (LIABILITY OF LANDOWNER FOR ALTERING GRADE OF LAND).
For primary bibliographic entry see Field 06E.
W71-02086

SOZANSKA V TOWN OF STRATFORD (DRAINAGE OF SURFACE WATER DISCHARGED FROM PUBLIC STREETS).
For primary bibliographic entry see Field 06E.
W71-02094

DUGAN V LONG (LIABILITY FOR DIVERSION OF NATURAL FLOW OF SURFACE WATER).
For primary bibliographic entry see Field 06E.
W71-02126

MILLER V PERKINS (OBSTRUCTION OF SURFACE RUNOFF).
For primary bibliographic entry see Field 06E.
W71-02186

2F. Groundwater

THE INFLUENCE OF GROUNDWATER SALINITY ON PLANT GROWTH,
Arizona Univ., Tucson. Environmental Research Lab.
James W. O'Leary.
American Association for the Advancement of Science, Committee on Desert and Arid Lands Zones Research, Groundwater Salinity Symposium, Las Vegas, New Mexico, April 23, 1970, paper presented. 13 p, 2 fig.

Descriptors: *Evapotranspiration, *Permeability, *Plant growth substances, *Saline water, *Groundwater, Salt tolerance, Arid lands, Irrigation practices, Plant physiology, Saline soils, Stomata, Turgidity, Leaves, Soil-water-plant relationships, Water balance, Irrigation canals, Humidity, Metabolism, Moisture deficit, Photosynthesis, Water utilization, Root systems, Moisture stress.
Identifiers: *Cytokinins, *Senescence, *Succulence.

Water flow in plant tissue is a direct function of tissue permeability and water potential. As groundwater salinity increases, plant growth invariably decreases. Current thinking assigns this result to decreases in root permeability. Under high evaporative conditions (low humidity), water stress occurs and tissue turgor decreases, resulting in partial stomatal closure which tends toward restoration of water balance equilibrium. Under low evaporative demand, water balance is maintained, but leaf succulence increases in the absence of leaf expansion - due to decreased cell wall extensibility which resembles cell senescence. Plants subjected to increasing salinity undergo decreasing root cytokinin synthesis which disrupts Krebs cycle activity and results in premature onset of senescence. This metabolic upset also decreases root cell permeability and water uptake. This is confirmed by decreased photosynthetic rates in stressed plants, which is reversed by cytokinin application to the leaves. In arid lands irrigation, salts are bound to accumulate in groundwater unless they are washed away. This process is most practical in coastal areas and least practical in inland areas. A note of caution is therefore sounded with respect to the Central Arizona Project which is an inland irrigation scheme. (Casey-Arizona)
W71-01701

GROUNDWATER IN THE POTOMAC RIVER BASIN,
Geological Survey, Arlington, Va.
F. W. Trainer, D. J. Cederstrom, and F. A. Watkins.
The Potomac Newsletter, Vol 14, No 6, p 1-6, June 24, 1970. 6 p, 11 ref.

Descriptors: *Groundwater, *Water supply, *Aquifers, *Water quality, Water pollution, Geology, Hydrology, Topography, Water wells.
Identifiers: *Potomac River Basin.

The Potomac River basin, in West Virginia, Pennsylvania, Maryland, Virginia, and the District of Columbia, extends across the middle Atlantic region from the Allegheny Plateau to Chesapeake Bay. It is characterized by wide diversity of terrain -- the sum of topography, rocks, and soils which forms the environmental framework of a region -- but in the broad view we can distinguish two water provinces: an upstream province of hard rocks, in the Appalachian Mountains, Blue Ridge, and Piedmont; and a downstream province, the Coastal Plain or Tidewater region, underlain by beds of relatively soft sand and clay. Despite broad similarity in climate thoughout the basin, the regional movement of water differs considerably in these two provinces, and water use and water problems also differ. Groundwater characteristics in the basin are reviewed under the following topics: The Water Supply; The Water System in the Upper Basin; The Water System in the Coastal Plain; The Availability of Groundwater; and Quality of the Groundwater. (Woodard-USGS)
W71-01815

HYDROGEOLOGIC DATA FOR THE LOWER THAMES AND SOUTHEASTERN COASTAL RIVER BASINS, CONNECTICUT,
Geological Survey, Hartford, Conn.
Michael A. Cervione, Jr., I. G. Grossman, and Chester E. Thomas, Jr.
Connecticut Water Resources Bulletin No 16, 1968. 65 p, 1 fig, 1 plate, 10 tab, 15 ref.

Descriptors: *Hydrologic data, *Water wells, *Streamflow, *Water quality, Data collections, Connecticut, Groundwater, River basins, Lakes, Reservoirs, Precipitation (Atmospheric), Sediment discharge.
Identifiers: Thames River (Conn), Hydrogeologic data.

This report presents data collected from 1963 to 1965 for an area of 440 sq mi in southeastern Connecticut and about 5 sq mi in Rhode Island. Records of 740 wells and 5 springs are given in tables showing location, owner or name, altitude, water-yielding material, and utilization, among other information. Logs of material penetrated in 229 wells and test holes are tabulated. Partial records of streamflow collected at 33 gaging stations are given, and one to three discharge measurements made at each of 25 miscellaneous sites during 1963 and 1964 are listed. Chemical analyses are tabulated for water from 195 wells and springs and for 283 samples from streams, lakes, and reservoirs. Analyses of suspended sediment and turbidity at 8 miscellaneous gaging sites, and chemical analyses of 38 precipitation samples from four sites are tabulated. Water resources data are plotted on a detailed topographic map with 10-foot contour intervals, scale 1:48000. (Lang-USGS)
W71-01816

SUBSURFACE WATER - GROUNDWATER,
Nevada Univ., Reno. Center for Water Resources Research.
George B. Maxey.
In: The Progress of Hydrology, Vol 2 - Specialized Hydrologic Subjects, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 787-815, published by Univ of Illinois, 1969. 29 p, 9 fig, 33 ref.

Descriptors: *International Hydrological Decade, Conferences, *Hydrogeology, *Reviews, *Groundwater movement, Research and development, Flow nets, Water chemistry, Water resources development, Forecasting, Hydrology, Hydraulics, Tracers, Tracking techniques, Systems analysis, Planning,

Projects, Research facilities, Exploration, Economics, Laboratories, Model studies, Technology, Computers, Instrumentation.
Identifiers: *Water resources research.

The literature of hydrogeology is reviewed with emphasis on work published since 1960. The demands of water-resource planning, development, and management in our time require attention by earth scientists to the whole water cycle and therefore to the interrelationships between the rocks and surface, soil, and groundwater. One of the major advances in hydrogeology in the past decade has been the recognition of the need to utilize more hydrodynamic principles in analysis of the natural situation. Specifically, recent developments stemming largely from the work of Hubbert (1940) and the application of flow net techniques have resulted in more realistic and highly applicable approaches to the solution of groundwater flow system problems. Theoretically, certain aspects of the hydrologic system could be reflected by the chemistry of the water involved. Similarly, radioactive tracers, such as radiocarbon and tritium, which allow, through age determinations, a knowledge of the velocity of movement of water may also be very helpful in system studies. Geologic data must be produced that can be reduced or developed into mathematical models which are subject to computer analysis. (Knapp-USGS)
W71-01831

GROUNDWATER HYDROLOGY - RECENT DEVELOPMENTS,
Princeton Univ., N.J., School of Engineering and Applied Science.
Roger J. M. De Wiest.
In: The Progress of Hydrology, Vol 2 - Specialized Hydrologic Subjects, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 816-820, published by Univ of Illinois, 1969. 5 p, 1 ref.

Descriptors: *International Hydrological Decade, Conferences, *Groundwater movement, *Hydrogeology, Reviews, Research and development, Mathematical models, Darcy's law, Porous media, Water resources development, Forecasting, Hydrology, Hydraulics, Aquifers, Computer models, Laboratories, Model studies, Technology, Computers, Instrumentation.
Identifiers: *Water resources research.

A summary account based on knowledge of Anglosaxon literature on groundwater hydrology is given of the progress that has been made since C. V. Theis founded modern well hydraulics in 1935. The simplest case of isothermal groundwater flow is mathematically described by the combination of an equation of conservation of mass and of a Darcy-type equation relating macroscopic velocity, head loss along the seepage path, and hydraulic conductivity of the medium. The resulting differential equation leads to the formulation of classical boundary and initial value problems. Most of the solutions available in the literature are concerned with only one aquifer. When more than one aquifer is present a system of simultaneous differential equations with suitable boundary conditions has to be solved and the results become very complicated. Therefore, practical problems can only be solved by means of analogs and computers. Among the analogs, the electric R - C model and the viscous flow model (Hele-Shaw apparatus) have been much refined in recent years and their use is now widespread. Unsteady unsaturated flow has been studied extensively by agronomists who also spent much time and effort in finding solutions to free surface flow problems. It has been possible to arrive at a Darcian-type description of two-phase fluid systems in heterogeneous porous media and to find solutions of some simplified problems by means of computers. In general, most of the research has been academic in nature and has helped very little in solving the day to day problems facing the practicing hydrologist. (Knapp-USGS)
W71-01832

A SHORT HISTORY OF HYDROLOGY,
Dept. of Energy, Mines and Resources, Ottawa (Ontario). Resources Research Center.
Asit K. Biswas.
In: The Progress of Hydrology, Vol 2 - Specialized Hydrologic Subjects, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 914-936, published by Univ of Illinois, 1969. 23 p, 1 fig, 1 tab, 22 ref.

Descriptors: *International Hydrological Decade, Conferences, *Education, *Hydrogeology, *History, Research and development, Groundwater movement, Water resources, Water resources development, Forecasting, Hydrology, Hydraulics, Technology.
Identifiers: *Water resources research.

The development of the science of hydrology is very briefly traced from about 3500 B.C. to the end of the nineteenth century. At present, very few hydrologists have a good knowledge of their heritage or have a broad understanding of how the science has developed even to its present imperfect state. Often undergraduate and graduate hydrology students have the impression that it is a new subject, which probably began in the twentieth century. It is strongly recommended that at least one hour be devoted, at the beginning of any course on hydrology, to the study of its special history. The time devoted for such a study would certainly be very well spend. (Knapp-USGS)
W71-01835

HYDROLOGIC DATA REDUCTION TECHNIQUES AND UNIT CONVERSIONS FOR USE IN THE OGRE, T-WAVE, FLIP, AND RAVE FLUID FLOW CODES,
California Univ., Livermore. Lawrence Radiation Lab.
John A. Korver.
Available from NTIS as UCRL-50854, $3.00 in paper copy, $0.95 in microfiche. March 13, 1970. 7 p, 2 tab, 1 fig, 6 ref.
Identifiers: *Groundwater, Gravity anomalies, *Gravity anomalies, *Programming (Computers), *Nuclear explosions, Hydrology, Computer programs, Coding, Mathematical models, Open channel flow, Incompressible flow, Flow charts, Input output routines, Radioactive wastes, T WAVE computer code, FORTRAN 2 programming language, FORTRAN, Finite difference theory.

Methods used to determine kH, the permeability-thickness product for a given location, from hydrologic test data are described, and methods for converting the units of permeability to the correct dimensional form for use in specific computer codes for analyzing ground water flow are presented. (See also W71-01886)
W71-01887

PRELIMINARY REPORT ON THE WATER RESOURCES OF NORTHEAST MAUI,
Geological Survey, Honolulu, Hawaii.
For primary bibliographic entry see Field 02E.
W71-01911

WATER RESOURCES INVENTORY OF CONNECTICUT - PART 4. SOUTHWESTERN COASTAL RIVER BASINS,
Geological Survey, Hartford, Conn.
For primary bibliographic entry see Field 02E.
W71-01912

REMOVAL OF SALINE WATER FROM AQUIFERS,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
For primary bibliographic entry see Field 05G.
W71-01932

QUANTITY OF WATER FLOWING INTO CIRCULAR INFILTRATION GALLERY,
Kyushu Univ., Fukuoka (Japan). Dept. of Hydraulic Civil Engineering.
For primary bibliographic entry see Field 02G.
W71-01933

STATISTICAL DETERMINATION OF PERMEABILITY BY THE PORE SIZE DISTRIBUTION IN POROUS MEDIA,
Osaka Univ. (Japan). Dept. of Civil Engineering; and Osaka Prefectural Technical Coll., Neyagawa (Japan).
For primary bibliographic entry see Field 02G.
W71-01934

GENERAL CHARACTERIZATION OF DIFFERENT TYPES OF SEEPAGE,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 04A.
W71-01935

STUDY OF GROUNDWATER MOUNDS UNDER SPREADING AREAS,
Indian Inst. of Tech. (Bombay).
For primary bibliographic entry see Field 04B.
W71-01936

THE SIMULATION OF THE MOVEMENT OF AN INTERFACE BETWEEM SALT AND FRESH WATERS IN A COASTAL AQUIFER BY THE AID OF AN RC ANALOG,
Technion - Israel Inst. of Tech., Haifa. Dept. of Civil Engineering.
For primary bibliographic entry see Field 07A.
W71-01941

A STUDY ON THE SEEPAGE FLOW OUT OF A FRESH WATER CANAL IN THE GROUND SATURATED WITH SEA WATER,
Kyushu Univ., Fukuoka (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 04A.
W71-01943

RELATIONSHIP BETWEEN VELOCITY OF SEEPAGE AND HYDRAULIC GRADIENT IN THE ZONE OF HIGH VELOCITY,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 08B.
W71-01947

THE LINEAR AND NON-LINEAR REGIMES OF THE FILTRATION LAW AND THEIR CONSEQUENCES IN GEOHYDRAULIC PROBLEMS,
Hydraulic Research Inst., Prague (Czechoslovakia).
F. Slepicka.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 57-65, 1969. 9 p, 2 fig.

Descriptors: *Groundwater movement, *Darcys law, Turbulent flow, Artesian wells, Flow, Porous media, Velocity, Turbulence, Froude number, Hydraulic conductivity, Hydraulic gradient.
Identifiers: Non-linear groundwater flow, Non-Darcian flow.

Expressions derived on the basis of theoretical analysis and verified experimentally show that: (a) the domain of validity of the linear filtration law has its lower and upper limits; (b) the conventional equations for free or artesian drawing wells may be precisely stated only in the case when the linear regime governs in the whole region influenced by the well; and (c) for conditions outside the limits of validity of the linear law, valid expressions may be derived for the non-linear regime. (Knapp-USGS)

W71-01948

SEEPAGE LAW FOR MICROSEEPAGE,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 04A.
W71-01950

FLOW OF IMMISCIBLE FLUIDS IN UNCONFINED AQUIFERS,
Themistocles Dracos, and H. Oliver Schiegg.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4, (Subject D), Science Council of Japan, Kyoto, p 17-23, 1969. 7 p, 5 fig, 5 ref.

Descriptors: *Groundwater movement, *Path of pollutants, *Oily water, *Hydraulic models, Model studies, Seepage, Aquifers, Soil water movement, Viscosity, Permeability, Darcy's law, Capillary conductivity.
Identifiers: *Oil spills, Immiscible flow, Multiphase flow.

The increase in the use of mineral oil products in the thickly populated areas of central Europe has led to a certain danger of pollution of important groundwater resources. Accidental infiltration of oil products during transport, transfer, and storage cannot be avoided. For the design of appropriate protective measures against oil pollution and for efficient sanitation after oil accidents it is necessary to understand the flow of liquid oil products in unconfined aquifers. The flow of oil products in unconfined aquifers and the problems arising from them were studied in laboratory models. The experiments were made in a tilting flume 4.0 m long and 0.20 m wide. The aquifer was simulated by a homogeneous quartz sand filling 0.60 m high through which a steady uniform flow of water was maintained with two overflows at the inlet and outlet of the flume. Following a phase of vertical infiltration, a horizontal spreading of the oil occurred inside the capillary fringe and above the phreatic line. In a homogeneous aquifer the oil spreads above the phreatic line and inside the capillary fringe. The oil spread is substantially slower than the groundwater flow and strongly decelerated when the oil feeding ceases. Determination of the water saturation distribution above the phreatic line shows that the oil spreads in the lower range of the zone, in which both the water and the air are in the funicular stage and hence both mobile. (Knapp-USGS)
W71-01951

2G. Water in Soils

THE INFLUENCE OF GROUNDWATER SALINITY ON PLANT GROWTH,
Arizona Univ., Tucson. Environmental Research Lab.
For primary bibliographic entry see Field 02F.
W71-01701

DIAGNOSIS OF SODIC CONDITIONS IN SALINE-ALKALI SOILS OF WESTERN RAJASTHAN,
Central Arid Zone Research Inst., Jodhpur (India).
A. S. Kolarkar, and N. Singh.
Annals of Arid Zone, Vol 9, No 1, p 31-35, March 1970. 3 fig, 8 ref.

Descriptors: *Laboratory tests, *Sodium, *Alkaline soils, *Saline soils, *Arid lands, Clays, Clay loam, Regression analysis, Soil profiles, Adsorption, Hydrogen ion concentration, Correlation analysis, Analytical techniques.
Identifiers: *West Rajasthan, *India, *Sodic conditions, *Sodium adsorption ratio (SAR), *Exchangeable sodium percentage.

Estimation of soil exchangeable sodium percentage (ESP) is expensive and time-consuming. Soil pH determinations are simple and quick and sodium adsorption ratios (SAR) are also easier to determine than ESP. Attempts were therefore made to find relationships between ESP and pH and ESP and SAR to facilitate easier ESP determination. Thirty-two saline-alkali soils from arid West Rajasthan were analyzed for all 3 characteristics. Simple linear regression lines were obtained for ESP vs. both SAR and pH. Because of the simpler techniques involved, it was felt that the pH-ESP relationship would be most useful. An equation developed by the U.S. Salinity Laboratory for ESP as a function for SAR was shown inadequate for these purposes. (Casey-Arizona)
W71-01706

EOLIAN SEDIMENT INFLUENCE ON PEDOGENESIS DURING THE QUATERNARY,
Wisconsin Univ., Madison. Department of Soil Science; Chicago Univ., Ill.; and California Univ., Riverside. Dept. of Geological Sciences.
J. K. Syers, M. L. Jackson, V. E. Berkheiser, R. N. Clayton, and R. W. Rex.
Soil Science, Vol 107, No 6, June 1969, p 421-427. 4 tab, 2 fig, 25 ref. AEC AT (11-1)-1515, NSF Grant GA-1108 and GA-1390.

Descriptors: *Aeolian soils, *Sierozems, *Soil gases, *Soil chemistry, *Quaternary period, Hydrologic properties, Soil physics, Aerosols, Arid lands, Loess, Quartz, Particle size, Winds, Sediments, Dusts, Deposition (Sediments), Oxygen, Fine-textured soils.
Identifiers: *Eolian sediment, *Pedogenesis, *Oxygen isotopic composition, *Aerosolic dust, *Wind-blown sediment, Trade winds, African dusts, Hawaiian soils, North-central U.S., East-central Pacific.

Loess and aerosolic dust can be detected in soils through determination of the oxygen isotopic composition of quartz as a particle-size function. These eolian deposits have developed extensive desert soils, and affect hydrologic properties of such soils. The delta-18-0 for fine silt varies from 16 for African dusts circulating in the Caribbean Trade Winds, to 18 for pelagic sediments of east-central Pacific, correlative Hawaiian soils, and arid land sources on the Asian continent, to 24 plus or minus 3 in calcareous loess of north-central USA. Delta values decrease with particle coarseness because of increasing granite-derived quartz contribution. Loess distribution is intracontinental. Aerosolic dust distribution is intercontinental. The aerosolic dusts are transported by world-wide winds, jet streams, rainfall and nuclear explosion. Tables show classification of selected minerals, soils, loess and aerosolic dust. The variation in oxygen isotopic weight with particle size of quartz, and location of study areas with respect to prevailing winds are shown. (Popkin-Arizona)
W71-01709

THE VEGETATION OF SUPERFICIAL IRONSTONE HARDPANS IN SIERRA LEONE,
Bristol Univ. (England). Dept. of Botany.
D. Gledhill.
Journal of Ecology, Vol 58, No 1, p 265-274, March 1970. 1 fig, 1 tab, 3 ref.

Descriptors: *Laterites, *Hardpan, *Vegetation, *Impervious soils, *Algae, Weathering, Microenvironment, Droughts, Drainage, Exposure, Erosion, Geomorphology, Soil water, Soil-water-plant relationships, Soil types, Soil density, Subsoil, Iron compounds, Soil groups, Tropical regions, Geologic formations, Wet seasons, Dry seasons, Topography, Climax, Plant populations.
Identifiers: *West Africa, *Sierra Leone, *Insular flora, *Algal mats, *Ironstone, Climax vegetation, Geologic age, Plant communities.

Laterites are red-brown earths rich in Fe, Cr, Al and Mn, occurring under forest and desert conditions alike. Their depths at given sites are dependent upon topography, seasonal changes in soil saturation by groundwater and the relationship between rates of laterization and erosion. Superficial ironstone hardpans occur in poorly drained sites owing to the uncovering of soil by surfacr erosion. Wherever found they are shallowly flooded by fresh water once a year. The habitats of 3 groups of hardpans in Sierra Leone, West Africa, are described together with their associated plant communities. Algal mats form in depressions and eroded areas and obstruct water flow across the surfaces. The algal species and all other plant species present are listed. The hardpan habitat is highly resistant to change, resulting in a specialized insular flora regarded as a climax under refuge conditions. Since the age of the flora depends on the age of the hardpan and slow successional and evolutionary changes, the possibility of determining the age of a hardpan from its flora is discussed. It is felt that the problem will have to be approached from a geological rather than a biological basis. (Casey-Arizona)
W71-01710

THERMODYNAMIC EQUILIBRIUM CONSTANTS OF SODIUM-CALCIUM EXCHANGE IN SOME ISRAEL SOILS,
National and Univ. Inst. of Agriculture, Rehovoth (Israel). Volcani Inst. of Agriculture Research; and Hebrew Univ., Jerusalem (Israel).
Rachel Levy, and D. Hillel.
National and University Institute of Agriculture, Rehovoth, Israel, 1967 Series, No 1186-E. Soil Science, Vol 106, No 5, November 1968, p 393-398. 3 tab, 2 fig, 8 equations, 13 ref.

Descriptors: *Thermodynamics, *Equilibrium, *Soil chemistry, *Calcium, *Sodium, Sierozems, Arid lands, Equations, Soil types, Clays, Loam, Ion exchange.
Identifiers: *Thermodynamic equilibrium constants, *Sodium-calcium exchange, *Soil-water relations, *Activity coefficient, *Israel, Exchangeable calcium, Electrostatic forces.

Sodium-calcium exchange thermodynamic equilibrium constants of three soil types of Israel were calculated by using the sodium monoform as a reference state and by ascribing an activity coefficient of 0.5 to the exchangeable calcium when at a mole fraction of unity. Thermodynamic equilibrium constant comparisons revealed that two of the soils (residual clay loam, sandy clay loam hamra) show a preference for calcium twice larger than the grumusolic silty clay. Interaction forces between the exchangeable ions and the soil matric were long-range electrostatic ones, but the role of other forces were important at low mole fractions of exchangeable sodium. Tables of solution composition, calculated values of selectivity coefficients, and calculated thermodynamic equilibrium constants are shown. Figures of exchange isotherms, and selectivity as a function of exchangeable mole fraction are included. (Popkin-Arizona)
W71-01717

ARTIFICIAL GROUNDWATER RECHARGE THROUGH BASINS IN THE TEXAS HIGH PLAINS,
Agriculture Research Service, Bushland, Tex.
For primary bibliographic entry see Field 04B.
W71-01719

STABILIZATION OF SHEAR-GENERATED SOIL AGGREGATES,
Minnesota Univ., Minneapolis. Dept. of Agricultural Engineering.
Lalit Mohan Arya.
M.S.Thesis, Minnesota University, December 1969. 63 p, 8 fig, 5 tab, 48 ref, append. OWRR Project No B-015-MINN (1).

Descriptors: *Soil structure, *Soil aggregates, Soil stability, Soil moisture, Soil physical properties, Soil mechanics, Soil strength, Shear strength, Soil texture, Soil management, Cultivation, Puddling, Soil treatment.
Identifiers: Soil-aggregate bonding.

Experiments were conducted to test the hypothesis that freshly formed aggregates in field soils stabilize over a period of time after formation. These aggregates included (1) natural aggregates from field soils collected immediately after plow-shearing, (2) simulated earthworn casts, and (3) aggregates produced by coalescence of dry soil particles around a droplet. In all cases, aggregates were aged at constant water content and wet-sieved at different times to investigate whether the stability increased with time. Natural aggregates from field soils showed an increasing stability with time. Simulated worm-casts increased in stability with aging as did shear-generated aggregates. Both initial and final stabilities of water-drop aggregates were lower than for plow-shear generated aggregates or simulated earthworm casts. There are important practical implications of these results. After plowing, secondary tillage should not be carried out until aggregates can withstand further shear forces. The waiting period should be at least 10 to 12 hours. Rain soon after plowing will do a greater damage to soil structure than at a later time when intra-aggregate bonds have strengthened. (Knapp-USGS)
W71-01771

SUBSURFACE WATER - GROUNDWATER,
Nevada Univ., Reno. Center for Water Resources Research.
For primary bibliographic entry see Field 02F.
W71-01831

THE MOVEMENT OF WATER IN UNSATURATED SOILS,
Illinois Univ., Urbana. Dept. of Soil Physics.
A. Klute.
In: The Progress of Hydrology, Vol 2 -Specialized Hydrologic Subjects, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 821-888, published by Univ of Illinois, 1969. 68 p, 21 fig, 1 tab, 103 ref.

Descriptors: *International Hydrological Decade, Conferences, *Soil-water movement, *Reviews, Bibliographies, Hydrogeology, Unsaturated flow, Saturated flow, Water chemistry, Research and development, Water resources development, Forecasting, Hydrology, Hydraulics, Soil chemistry, Porous media, Evapotranspiration, Soil-water-plant relationships, Model studies.
Identifiers: *Water resources research, Soil water-groundwater relationships.

The part of the hydrologic cycle which deals with the transport of water in the soil profile down to and including the water table is reviewed. The processes of infiltration, redistribution, percolation, drainage and evaporation occur in this region. A soil profile is characteristically nonuniform in its properties, nonisothermal, and may be nonrigid. Microorganisms and the roots of higher plants are a very intimate part of the system. The region is characterized by cyclic fluctuation of water content as water is removed from the soil profile by evapotranspiration and replenished by rainfall or irrigation. The movement and retention of water in unsaturated porous media may be approached from (a) the molecular, (b) the microscopic or (c) the macroscopic viewpoint. It is quite evident that recharge of the groundwater and discharge from it must traverse the unsaturated zone by way of the processes of infiltration, percolation and evaporation. Soil physicists have not given much attention to groundwater flow, and conversely groundwater hydrologists have tended to avoid consideration of the unsaturated flow region. The groundwater flow region and the unsaturated region above it are part of a continuous and interacting system. The flow of water in the entire system can be physically and mathematically described without the imposition of artificial boundaries. It is probable that there are simplifying assumptions that can be made that would incorporate the essential features of unsaturated flow theory into the treatment of a groundwater problem. Exactly what these may be will have to be determined after study of the problem based on unified flow models. (Knapp-USGS)
W71-01833

QUANTITY OF WATER FLOWING INTO CIRCULAR INFILTRATION GALLERY,
Kyushu Univ., Fukuoka (Japan). Dept. of Hydraulic Civil Engineering.
Toshihiko Ueda, and Satoru Sugio.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 175-182, 1969. 8 p, 9 fig, 4 ref.

Descriptors: *Groundwater movement, *Water wells, Mathematical models, Analog models, Hydraulic models, Aquifers, Water levels, Mathematical studies, Tunnels, Conjunctive use, Surface-groundwater relationships.
Identifiers: *Infiltration galleries, Horizontal wells.

Flow of water into a circular infiltration gallery was studied under the condition that uniform and water-saturated soil is covered by ponded water. The equation in which a theoretical sink point is used is derived first for an infinite flow field, and then for a rectangular flow field as a general type. The case where the conduit is not filled with water is also considered. An approximate equation for a rectangular flow field is presented, using the Jacobian elliptic function. The accuracy of these investigations is confirmed experimentally by tests conducted on an electrical analog model and a sand model. (Knapp-USGS)
W71-01933

STATISTICAL DETERMINATION OF PERMEABILITY BY THE PORE SIZE DISTRIBUTION IN POROUS MEDIA,
Osaka Univ. (Japan). Dept. of Civil Engineering; and Osaka Prefectural Technical Coll., Neyagawa (Japan).
Akira Murota, and Kuniaki Sato.
French synopsis. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 183-190, 1969. 8 p, 7 fig.

Descriptors: *Flow, *Porous media, *Groundwater movement, *Absorption, *Capillary water, Darcys law, Viscosity, Adhesion, Seepage, Soil water movement, Fluid mechanics, Porosity, Permeability, Particle shape, Particle size.
Identifiers: *Pore size distribution, Sorting, Pore shape, Pore size.

Estimation of permeability includes some obscurities, particularly in expression of a representative grain size and in dealing with absorbed water. In order to introduce the effect of absorbed water, a microscopic flow-field of fluid molecules is assumed in which a coefficient of high-viscosity is adopted. The flow patterns of seepage are phenomenally classified into three regions by characteristic pore sizes: the non-seeping, the high-viscous, and Darcy's flow region. Expressions are presented for permeability in each region. (Knapp-USGS)
W71-01934

GENERAL CHARACTERIZATION OF DIFFERENT TYPES OF SEEPAGE,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 04A.
W71-01935

A STUDY ON THE SEEPAGE FLOW OUT OF A FRESH WATER CANAL IN THE GROUND SATURATED WITH SEA WATER,
Kyushu Univ., Fukuoka (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 04A.
W71-01943

FILTRATION PROBLEMS OF IRRIGATING AND WASHING SALINIZED SOILS,
Akademiya Nauk SSSR, Novosibirsk.
P. Ya. Polubarinova-Kochina, V. I. Penkovsky, S. T. Rybakova, and V. N. Emikh.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 77-84, 1969. 8 p, 6 fig.

Descriptors: *Irrigation water, *Leaching, *Drainage systems, *Saline soils, Diffusion, Groundwater movement, Mathematical studies, Drainage engineering, Drainage water, Irrigation programs, Outlets, Laterals, Water management (Applied).
Identifiers: USSR.

The study of desalinization of soils by washing gave rise to a number of problems including dissolving salts, the behavior of salts in groundwater, diffusion, physico-chemical phenomena, and the water filtration rate in the washing process. Salinized soils are mostly washed by flooding a certain area with subsequent draining of wash water into open or closed tubular horizontal outlets. The solution obtained is expressed in a parametric form in terms of elliptic integrals. The diffusion equation can be integrated numerically and gives the salinity distribution at different times. (Knapp-USGS)
W71-01945

SEEPAGE LAW FOR MICROSEEPAGE,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 04A.
W71-01950

ADVANCE OF IRRIGATION WATER ON THE SOIL SURFACE IN RELATION TO SOIL INFILTRATION RATE: A MATHEMATICAL AND LABORATORY MODEL STUDY,
Iowa State Univ., Ames. Dept. of Agronomy.
Mohamed Asseed, and Don Kirkham.
Iowa State University Agriculture and Home Economics Experiment Station Research Bulletin 565, p 293-317, September 1968. 25 p, 24 fig, 1 tab, 33 ref. OWRR Project A-003-IA (13).

Descriptors: *Irrigation water, *Soil surfaces, *Infiltration, *Soil water movement, *Model studies, Soil moisture, Mathematical studies, Equations, Laboratory tests, Soils, Soil density, Porous media, Storage capacity, Permeability, Resistivity, Hydraulics, Topography.
Identifiers: *Iowa State University.

Mathematical equations describing the horizontal advance of an irrigation stream on a soil surface are derived and discussed for different types of infiltration equations corresponding to different known field conditions. Complex variable theory is applied to transform certain complicated forms of infiltration equation solutions to algebraic forms. An irrigation model having a visible Plexiglas photographic front was constructed and operated to test the theory and obtain data not covered by the theory. Glass beads or soil aggregates constitute the porous medium; water is used as the seepage fluid. Potassium dichromate dye is injected into the porous medium to trace the direction and velocity of the stream lines when the water moves within the body of the porous medium. The model data are recorded by photography and show a good agreement between theory and experiment for both the calculated position of the 'irrigation' front on the porous media and the 'wetted' front below the surface. Comparisons were made between experimental data and theory for two slopes of land, for five porous media, for two irrigation rates, and for two surface conditions, rough and smooth. Dimensionless functions are developed to present the model data. (Knapp-USGS)
W71-01964

KINETICS AND ENERGETICS OF ADSORPTION AND DESORPTION OF MINERAL NUTRIENTS FROM SOIL MINERALS,
Utah Agricultural Experiment Station, Logan.
R. L. Smith.
Available from NTIS as COO 139211, $3.00 in paper copy, $0.95 in microfiche. March 9, 1970. 7 p, 8 fig, 1 ref. Contract AT (11-1)-1392-5.
Identifiers: *Soils, Adsorption, Thermodynamics, Kinetic theory, Desorption, *Soil chemistry, Nutrients.

In principle, obtaining kinetic data of ion adsorption by mineral surfaces is simple. The procedure is to determine how the ion concentration in solution varies with time in the presence of a given amount of solid, holding the temperature of the system constant. However, usually the solid phase must be separated from the aqueous phase before the ion concentration is determined. This is usually done by removing the sample from the thermostat (water bath) centrifuging it in a temperature-controlled high speed centrifuge (plus or minus 1C) and analyzing the supernatant liquid. Because of the time involved and the lack of precision temperature control using the high speed centrifuge, accurate kinetic data, involving short reaction times, are precluded. The past year was dedicated to a study of experimental techniques which would allow elimination of the centrifuge in adsorption kinetic. The feasibility of using a dialysis membrane bag to separate the solid from the aqueous solution was investigated. The membrane allows the free diffusion of ions in solution but restrains the solid phase with the bag. The aqueous solution can then be readily pipetted from a reaction flask and analyzed without removing the reaction flask from the water bath.
W71-01991

THE EFFECTS OF FARMYARD MANURE ON MATRIC SUCTIONS PREVAILING IN A SANDY LOAM SOIL,
National Vegetable Research Station, Wellesbourne (England).
For primary bibliographic entry see Field 05D.
W71-02034

2H. Lakes

THE CYCLOPID FAUNA OF THE LITTORAL ZONE OF RYBINSK RESERVOIR,
Bureau of Sport Fisheries and Wildlife, Narragansett, R.I. Narragansett Marine Game Fish Research Lab.
A. V. Monakov.
Trans. From: (Biologiya I Troficheskie Svyazi Presnovodnykh Bespozvonochnykh I Ryb. Sbornik Statei. Akademiya Nauk SSSR, Institut Biologii Vnutrennikh Vod, Trudy, No. 17 (20), 'Nauka', Leningrad, 1968, pp 33-40. Available from NTIS as PB-189 892T, $3.00 in paper copy, $0.95 in microfiche. Russian trans by Narragansett Marine Game Fish Research Lab, June 1969. 11 p, 19 ref.
Identifiers: *Crustacea, *Lakes, *Plankton, Lakes, Population, Ecology, Food, Nutrition, Distribution, Marine biology, USSR, *Cyclopids, Food chains, *Phytoplankton.

Twenty-six species of cyclops live in the littoral zone of Rybinsk Reservoir, of which the most numerous four are: Acanthocyclops viridis, Macrocyciops albidus, Microcyclops varicans and M. bicolor. The degree of overgrowth and the depth of the littoral zone are factors which determine the composition, abundance and distribution of cyclopids. The maximal abundance and greatest number of species are seen in the shallows which are overgrown with sedges and horsetails; the minimal - at greater depths among the reeds. The total biomass of cyclops during the period from May through October undergoes considerable fluctuations, but provides two clearly expressed maximums: the first - with a biomass of 0.35 g/m3 at the end of May, two weeks after flooding of the littoral zone; the second - with a biomass of 0.4 g/m3 at the end of August. Two species chiefly specify the quantity of the total biomass - Acanthocyclops viridis and Macrocyclops albidus. The middle of summer is characterized by numerical predominance of the small phytophilic species of Microcyclops and forms of the pelagic plankton - Mesocyclops leuckarti.
W71-01663

RADIOCESIUM KINETICS IN THE COMPONENTS OF A MONTANE LAKE ECOSYSTEM,
Colorado State Univ., Fort Collins. Dept. of Radiology and Radiation Biology.
Anthony F. Gallegos.
Available from NTIS as COO-115 634, $3.00 in paper copy, $0.95 in microfiche. Ph. D. Thesis, Colorado State Univ, December 1969. 342 p, 79 tab, 29 fig, 99 ref, append. AEC AT (11-1)-1156.
Identifiers: *Lakes, *Ecology, *Radioactive isotopes, Lakes, Retention, Fishes, Cesium.

Combined laboratory aquarium and lake observations with important components in the East Twin Lake ecosystem were utilized in the synthesis of a radiocesium kinetics compartment model for predicting the build-up of this radionuclide in the tissues of fish and other components at the lake. Analysis of Cs-137 build-up data in fish obtained from the lake by a postulated biological model showed that the required daily intake of radiocesium was about ten times greater than that obtained from their food sources. Close to 80 per cent of the diet of rainbow trout in ETL consisted of Gammarus lacustris, while most of the remainder consisted of Daphnia pulex. Sediment uptake by fish is postuted as the major cause of radiocesium build-up in fish at ETL, as 20 to 40 per cent of the absorbed radiocesium is removed by the gut of rainbow trout. Qualitative identification of feldspars and quartz in the stomach and intestinal contents of rainbow trout from ETL also lends support to this theory. In addition to the compartment model synthesis for various components at ETL, a chronic ingestion model was also derived for rainbow trout at ETL utilizing the Cs-137 build-up data, Cs-134 excretion experiments in rainbow trout, and Cs-134 tissue distribution studies on these fish. The effect of temperature and weight of fish on the retention of radiocesium by rainbow trout was studied in a laboratory aquarium system designed to have refrigeration capacity, and to provide for treatment of solid and dissolved organic matter derived from fish wastes. A weight/temperature interaction term was shown to affect the overall excretion pattern of radiocesium as a function of time. Retention half-times of the long component in these fish were observed to be affected not only by a weight/temperature interaction term, but also by the per cent weight increase of the fish during the test interval. Laboratory experiments with Gammarus lacustris in aquaria contaminated with Cs-134 showed that the concentration factor of these organisms at equilibrium was largely dependent on the water radiocesium concentration. Limnological studies at ETL provided most of the necessary information required for proper description of this ecosystem in terms of radiocesium movement and pool size estimates. The total Cs-137 inventory of ETL was estimated to be 10 mCi.
W71-01671

STATE V TIMOTHY (DOCTRINE OF PURPRESTURE LIMITS PRIVATE CONSTRUCTION ON LAKE BED).
For primary bibliographic entry see Field 06E.
W71-01673

DYNAMICS OF ABUNDANCE OF GENERATIONS AND THE GROWTH OF THE BREAM IN KUIBYSHEV RESERVOIR,
Bureau of Sport Fisheries and Wildlife, Narragansett, R. I. Narragansett Marine Game Fish Research Lab.
I. V. Sharonov.
Available from NTIS as PB-189 130T, $3.00 in paper copy, $0.95 in microfiche. Biologiya i troficheskie svyazi presnovodnykh bespozvonochnykh i rby. Sbornik statei. Akademiya Nauk SSSR, institut biologii vnutrennikh vod, trudy, no. 17 (20), 'Nauka', Leningrad, 1968. p 151-179. Transl. of Narragansett Marine Game Fish Reasearch Lab., July, 1969. 38 p, 62 ref.
Identifiers: *Fishes, USSR, Abundance, Ecology, Growth, Dams, Sampling, Reproduction, Physiology, Eggs, Bream, Kuibyshev reservoir, Spawning.

Among the commercial fishes of Kuibyshev Reservoir, the bream occupies first place. According to the plan for fishery development, the catch of bream must comprise 35 percent of the total fish yield, and the reservoir must remain a typical bream water. If the ecological spectrum of a species at all stages of development corresponds to the new conditions, then its population flourishes and its abundance increases. Change of living conditions causes changes in the biological indices of a population, including the periods of onset of sexual maturity and the period of reproduction, fertility, growth rate, structure and density. Clarification of these phenomena in their interconnection with the conditions which arise in a new body of water helps one to see into the nature of the process of formation of a stock, and facilitates the development of measures for increasing the abundance of a population and the most rational exploitation of it for economic interests.
W71-01675

STOCK ASSESSMENT BY ECHO INTEGRATION AND ITS APPLICATION TO JUVENILE SOCKEYE SALMON IN LAKE WASHINGTON,
Washington Univ., Seattle. Fisheries Research Inst.
Richard E. Thorne, and James C. Woodey.
Available from NTIS as PB-190 366, $3.00 in paper copy, $0.95 in microfiche. January 28, 1970. Circular No. 70-2.
Identifiers: Lake Washington (Wash), Washington, Salmon, Echo integrators, Fish surveys, Onchorhynchus nerka, *Fishes, Counting methods, *Echo ranging, Fishes, Population, Abundance, Underwater sound signals, Transducers, Detectors, Ultrasonic radiation, Depth finding, Lakes, Theses.

An echo integrator for use in the estimation of fish populations was designed and built. The first part of this paper describes an investigation into the relationship between the integrated echo strength of the echo integrator and number of juvenile sockeye salmon. The second part details an estimation of the pelagial population of presmolt sockeye salmon in Lake Washington by means of the echo integrator.
W71-01678

ALKALINITY AND FORMATION OF ZEOLITES IN SALINE ALKALINE LAKES,
Wyoming Univ., Laramie. Dept. of Geology.
Robert H. Mariner, and Ronald C. Surdam.
Science, Vol 170, No 3961, p 977-980, November 1970. 4 p, 3 fig, 1 tab, 19 ref. American Chemical Society Grant 3809-A2 PRF-ACS.

Descriptors: *Zeolites, *Alkaline water, *Lakes, *Gels, Model studies, Silicates, Sedimentary tuff, Rhyolites, Saline water, Chemical precipitation.
Identifiers: *Silica solubility, Zeolite mineralogy.

Where authigenic silicates are forming today, a relationship has been noted between the Si/Al ratio of the low-temperature zeolitic alteration products of silicic glass and the alkalinity of lake waters responsible for that alteration. A model is suggested to explain the relationship. The solubility of rhyolitic glass increases with increasing alkalinity, whereas the ratio of silicon to aluminum decreases with increasing alkalinity. Strong correlation observed between alkalinity and zeolite mineralogy in saline, alkaline lakes is a function of the relationship between pH and the Si/Al ratio. This function is probably a result of the reaction between silicic glass and alkaline solution whereby (1) a gel forms, whose Si/Al ratio is controlled by the Si/Al ratio of the solution, and (2) a zeolite forms from the gel,

whose Si/Al ratio is, in turn, controlled by the composition of the gel. (Land-USGS)
W71-01903

THE PREDICTION OF WITHDRAWAL LAYER THICKNESS IN DENSITY STRATIFIED RESERVOIRS,
Tennessee Valley Authority, Norris. Engineering Lab.
Rex A. Elder, and Walter O. Wunderlich.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2, (Subject B), Science Council of Japan, Kyoto, p 309-316, 1969. 8p, 3 fig, 2 tab, 5 ref.

Descriptors: *Forecasting, *Withdrawal, *Boundary layers, *Density stratification, *Reservoirs, Consumptive use, Water, Interfaces, Flow, Profiles, Mathematics, Equations, Water analysis, Remote sensing, Model studies, Electrodialysis.
Identifiers: Field and laboratory data relationships, Tennessee Valley Authority, Sensor.

Direct measurements of the withdrawal layer thickness and its internal velocity distribution were made by the Tennessee Valley Authority in two of its large reservoirs. These reservoirs (Fontana and Cherokee) have very different geometry. The measurements were made using a 'Deep Water Isotopic Current Analyzer'. Integration of the measured velocity profiles over depth and width of the withdrawal layer yielded flow rates in good agreement with the powerhouse discharges. Extending the integration over the temperature profile yielded a result in good agreement with the outflow temperatures. Equations which have been proposed for the prediction of the withdrawal layer thickness and flow distribution were checked for their applicability to the field data. Although the results obtained up to now are not entirely conclusive and more tests need to be conducted, valuable experiences were gained for immediate application in water quality prediction models. (Woodard-USGS)
W71-01954

COLORADO TROUT LAKE STUDIES,
Colorado Dept. of Natural Resources, Fort Collins.
Wesley C. Nelson.
Available from NTIS as TID-25342, $3.00 in paper copy, $0.95 in microfiche. Progress Report for 1969, 20 Jan 70. 12 p, 6 ref.

Descriptors: Colorado.
Identifiers: *Lakes, *Ecology, *Fishes, Lakes, *Radiological contamination, Limnology.

Limnological measurements were made on water temperature, depth of secchi disk visibility and dissolved oxygen concentrations. All fish caught were identified, sexed, weighed, and measured, and representative samples were taken for analysis of 137Cs concentrations in muscle tissue. Results of studies on three lakes are tabulated. Mean concentrations of 137Cs remained relatively high in rainbow trout from Lower Agnes Lake, and cutthroat trout from Upper Snow Lake. From these results it is concluded that in the event of renewed contamination of the environment by radioactive fallout, the larger fish from similar montane and alpine lakes would present the greatest potential health hazard if caught and consumed by fishermen.
W71-01989

SEA GRANT ACTIVITIES.
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 09D.
W71-02054

CITY OF SHREVEPORT V WILKINSON (CONSTITUTIONALITY OF ORDINANCE DENYING ACCESS TO LANDOWNER'S HOME).
For primary bibliographic entry see Field 06E.
W71-02169

2I. Water in Plants

STUDIES ON THE INFLUENCE OF MIST IRRIGATION ON THE MICROENVIRONMENT, GROWTH, AND DEVELOPMENT OF THE POTATO (SOLANUM TUBEROSUM),
Minnesota Univ., Minneapolis.
Douglas Charles Sanders.
Ph D Thesis, University of Minnesota, December, 1970. 112 p, 3 tab, 4 fig, 18 ref. OWRR Project B-013-MINN (1).

Descriptors: Plants, *Potatoes, *Moisture stress, *Irrigation, *Irrigation effects, Crops responses, Plant growth, Soil-water-plant relationships, Irrigation practices.

The influence of irrigation method on the microenvironment, growth and development, foiliage nutrient content, and tuber quality of the potato was assessed during three seasons. Low volume 'mist' irrigation (M), furrow irrigation (F), mist plus furrow (MF) and no irrigation (NI) were compared. Misted (M) canopies had lower leaf, air, and soil temperatures and higher soil moisture than NI canopies. Stomata of misted plants did not close as rapidly as those of non-irrigated plants. During high and moderate stress seasons misting delayed haulm senescence and increased the proportion of small and medium size tubers. Further during the high stress season the misted plots yielded more than NI plots. During the latter part of two seasons the leaves from NI plots contained less P and K and more Fe than leaves from M and MF plots. Leaves from F treated plots were similar to those from NI treated plots in nutrient content except that P was lower in the latter. Leaves and petioles of M and MF plants consistently contained more Zn than those of NI or F plants throughout all three seasons. Tubers from misted treatments (M and MF) tended to be lower in dry matter, had a high incidence of secondary growth and hollowheart, yielded darker chips, required more time to recondition, were less mature and contained more reducing sugars than those from NI treatments. Further the tubers from misted treatments contained more P, Mg, Ca, Fe, Al, B and Mn than those from NI plots at various times during the latter part of the season. Mist irrigation can be a viable means of reducing internal plant moisture stress and increasing yields of potatoes.
W71-01656

PART I, CONTROLLING THE SOIL MOISTURE ENVIRONMENT OF TRANSPIRING PLANTS, PART II, PREDICTION OF LEAF TEMPERATURE UNDER NATURAL ATMOSPHERIC CONDITIONS,
Kentucky Water Resources Inst., Lexington.
Charles T. Haan, Billy J. Barfield, and Robert Edling.
Available from NTIS as PB-195 831, $3.00 in paper copy, $0.95 in microfiche. Research Report No. 30, 1970. 67 p, 7 tab, 17 fig, 29 ref. OWRR Project A-017-KY (1).

Descriptors: *Transpiration, *Soil moisture, Micrometeorology, Plants, Soil-water-plant relationships, Temperature, Energy budget, Evaporation, Transpiration control.
Identifiers: *Leaf temperature, Mist irrigation, Plant root zone.

Part I: A technique for controlling the soil moisture potential in the root zone of transpiring plants was developed. The method uses the principles of unsaturated flow through a porous media to develop the desired moisture potential. In the case of nonsteady state transpiration, the maximum possible fluctuation in the soil moisture potential can be determined by the techniques presented. Part II: Two implicit leaf temperature prediction equations were derived from the energy balance approach. The equations define sensible and latent heat transfer from a plant population as a two step process: (1) Transfer between the plant leaf and the canopy bulk air, and; (2) transfer between the canopy bulk air and the atmosphere. Boundary layer concepts were applied to leaf heat transfer in both equations. Turbulent atmospheric transfer by free and forced convection were considered. Measurements of leaf temperature and wind velocity, temperature and humidity profiles for a cucumber plot were taken during ten tests. Richardson numbers to classify atmospheric stability were determined. The neutral wind velocity profile parameters, roughness height and zero displacement height were determined by a computerized least squares technique using data from the ten tests. Calculated Richardson's numbers indicated transfer by free convection. Comparison of predicted and meausred leaf temperatures revealed the forced convection prediction equations considerably over estimated leaf temperature while the free convection predictions was much more accurate.
W71-01660

THE INFLUENCE OF GROUNDWATER SALINITY ON PLANT GROWTH,
Arizona Univ., Tucson. Environmental Research Lab.
For primary bibliographic entry see Field 02F.
W71-01701

OSMOTIC AND 'TOXIC' EFFECTS OF SALINITY ON GERMINATION OF PHASEOLUS VULGARIS L. SEEDS,
Arizona Univ., Tucson. Environmental Research Lab.
Jose Tarquinio Prisco, and James W. O'Leary.
Turrialba, Vol 20, No 2, p 177-184, April-June 1970. 6 tab, 31 ref.

Descriptors: *Absorption, *Toxicity, *Osmotic pressure, *Germination, *Seeds, Sodium chloride, Salt tolerance, Laboratory tests, Plant growth, Beans, Saline soils, Root systems.
Identifiers: *Water potential, *Radicle emergence, *Carbowax, *Matric potential, *Imbibition, Kidney beans.

In studying the effects of saline substrates on seeds it is important to differentiate between simultaneously operating toxic and osmotic effects. Red kidney bean seeds were exposed to nutrient media containing either NaCl or Carbowax 1540 at water potentials of 0, -2, -4, -8, -12 and -16 bars. Effects on water absorption, radicle emergence, seed germination and seedling development were measured. At 6 hrs, seeds in both NaCl and Carbowax solutions revealed no differences in water absorption regardless of solution water potential. After 12 hrs, significantly less seed water absorption occurred in NaCl solutions of -8 bars or less, while all Carbowax solutions showed less absorption. This suggest that up to 12 hrs, water absorption was mainly a function of seed matric potential and was thereafter dependent on osmotic potential. Differences between Carbowax and NaCl were due to NaCl seed penetrability followed by osmotic adjustment. At -12 bars and lower, fewer radicles emerged in NaCl than Carbowax solutions, indicating toxic effects of NaCl at these higher salinity levels. Since most emerged radicles did not continue to germination, it was felt that radicle emergence is an inadequate germination criterion. Carbowax affects root growth more than shoot growth while the opposite is true for NaCl. Carbowax 1540 does not appear to be phytotoxic. (Casey-Arizona)
W71-01702

SUBSURFACE APPLICATION AND SHALLOW INCORPORATION OF HERBICIDES ON COTTON,
Southwestern Great Plains Research Center, Bushland, Tex.
A. F. Wiese, and E. B. Hudspeth, Jr.
Texas Agricultural Experiment Station, Technical Article 5989. Weed Science, Vol 16, No 4, October 1968, p 494-498. 7 tab, 1 fig, 11 ref.

Descriptors: *Herbicides, *Weed control, *Cotton, *Crop production, *Plant growth regulators, Crop

response, Rainfall, Arid lands, Application methods, Spraying, Equipment, Soil types, Soil surfaces, Texas.
Identifiers: *Herbicide application, *Herbicide incorporation, *Herbicide performance, *Crop management, Diuron, Prometryne, Norea, DCPA, Fluometuron, Trifluralin.

Herbicides left on soil surface in dry areas frequently disappear before rain occurs. This 3-year study was to determine if various incorporation methods would improve herbicide performance over a wide range of conditions. Subsurface application just ahead of a planter with a device that removed the top from the bed, applied a spray, and covered it with soil reduced weed control in cotton more than surface applications. Sprays consisted of diuron, prometryne, norea, DCPA, fluometuron and trifluralin. The machine improved weed control with trifluralin. After planting shallow incorporation with two helical blades increased weed control with trifluralin, diuron, and DCPA by 10 percent or more over the surface application. This incorporator increased by 5 percent weed control obtained with prometryne and norea. Very shallow incorporation with metal tines after planting improved weed control obtained with trifluralin and DCPA by 18 and 11 percent. Weed control with norea was increased 7 percent. Compared to surface application, incorporation increased cotton injury with diuron, norea, prometryne and fluometuron on sandy loam soil. A figure shows applicators and incorporators and 7 tables quantify the relationships. (Popkin-Arizona)
W71-01704

COMPARATIVE PHOTOSYNTHESIS, GROWTH AND TRANSPIRATION OF TWO SPECIES OF ATRIPLEX,
Australian National Univ., Canberra. Research School of Biological Sciences.
R. O. Slatyer.
Planta (Berlin), Vol 93, No 3, p 175-189, 1970. 4 fig, 1 tab, 19 ref.

Descriptors: *Photosynthesis, *Transpiration, *Plant growth, *Leaves, *Stomata, Xerophytes, Carbon dioxide, Permeability, Resistance, Biological communities, Water conservation, Water utilization, Efficiencies, Physiological ecology, Plant physiology, Metabolism, Laboratory tests, Growth rates.
Identifiers: *Assimilation, *Seedlings, Mesophytes.

To compare photosynthetic efficiency as a function of water use in both single leaves and whole plants, seedlings of 2 species of Atriplex were studied--spongiosa (xerophytic C sub 4) and hastata (mesophytic C sub 3). Initially, spongiosa showed higher growth rate, assimilation rate and water use efficiency and lower transpiration rate. These were reflected in greater leaf area. As the experiment progressed (over 23 days), spongiosa/hastata ratios of growth and leaf area declined steeply to less than 1.0 while the assimilation ratio declined slightly to 1.0. Water use efficiency and transpiration rate ratios remained relatively constant both in seedlings and single leaves. These results indicated that the C sub 4 species was capable of more efficient photosynthesis but that this is only one minor factor in total growth rate. Mesophyll resistance (r sub m) was consistently lower in spongiosa while stomatal resistance (r sub l) was consistently higher. Both increased with time. Comparable water exchange and carbon dioxide exchange values in single leaves and seedlings provide a more rational basis for interpreting single leaf responses in terms of whole plant and community data. Spongiosa produces photosynthate more efficiently in critical early growth stages. An efficient photosynthetic apparatus (low r sub m) combined with a relatively impermeable gas pathway (high r sub l) reveal an elegant aridity adaptation. (Casey-Arizona)
W71-01708

THE VEGETATION OF SUPERFICIAL IRONSTONE HARDPANS IN SIERRA LEONE,
Bristol Univ. (England). Dept. of Botany.
For primary bibliographic entry see Field 02G.
W71-01710

THE INFLUENCE OF TILLAGE PRACTICES ON YIELDS AND WEED CONTROL IN SAFFLOWER,
Nebraska Univ., Lincoln. Dept. of Agronomy; and Lincoln Univ., Mitchell. Scotts Bluff Experiment Station.
C. R. Fenster, and L. R. Robison.
Nebraska Agricultural Experiment Station, Journal Series Paper No 2205. Weed Science, Vol 16, No 3, July 1968, p 326-328. 2 tab, 6 ref.

Descriptors: *Cultivation, *Crop production, *Weed control, *Safflower, *Economic efficiency, Plant growth regulators, Soil moisture, Moisture content, Humidity, Semiarid climates, Arid climates.
Identifiers: *Tillage practices, *Crop management, *Tillage tools, Sweep machine, Oneway plow, Moldboard plow, Plots.

Dry atmospheric conditions (low relative humidity) and adequate soil moisture are necessary during the growing season of safflower for economical production. An experiment to investigate tillage practices for producing safflower and controlling weeds was conducted from 1963 to 1965. Three tillage intensities (excessive, moderate, minimum) depending on the number and kind of tillage operations were used. Three different tillage tools used as primary preparation implements were sweep machine, oneway and moldboard plow. Excessive, moderate and minimum tillage plots averaged 342, 374 and 413 lb/A of safflower and 72, 73, and 63 lb/A of weeds. Sweep machine plots produced the highest safflower yields and lowest weed yields at all intensities, with the oneway and moldboard plow about the same. Yields produced from the best treatment in the experiment (minimum tillage with the sweep machine and seeding with the shoe drill) averaged 300 lb/A more than commercial fields and weed control was effective. Tables show weed and safflower yields under three different tillage regimes. (Popkin-Arizona)
W71-01711

PRODUCTIVITY STUDIES ON HEATH VEGETATION IN SOUTHERN AUSTRALIA. THE USE OF FERTILIZER IN STUDIES OF PRODUCTION PROCESSES,
Melbourne Univ., Parkville (Australia). Dept. of Botany.
Richard Jones.
Folia Geobotanica et Phytotaxonomica, Vol 3, No 4, p 355-362, 1968. 5 tab, 7 ref.

Descriptors: *Productivity, *Biomass, *Fertilizers, *Leaves, *Plant growth, Semiarid climates, Phosphates, Nitrogen, On-site investigations, Biological communities, Ecosystems, Data collections, Vegetation, Crop production, Nutrients.
Identifiers: *Heaths, *Leaf area, *Australia.

Australian heaths are low in plant productivity because of low soil nutrient status. As a prelude to a study on fertilizer effects on water use, the fertilizer effects on above-and below-ground plant parts, including leaf area, were studied in a heath community. Square plots of 10 m sides were established and half were randomly fertilized with superphosphate (1000 kg/ha). An analysis of variance was performed on yield data. Increases in biomass and leaf area were minimal for the first 2 years after application. There was no demonstrable fertilizer effect on below-ground growth. It is felt that a permanently detectable indication of increased growth may only be possible after several years of annual application. (Casey-Arizona)
W71-01712

IS ANY ANGIOSPERM AN OBLIGATE HALOPHYTE,
California Univ., Davis. Dept. of Botany.
Michael G. Barbour.
American Midland Naturalist, Vol 84, No 1, p 105-120, 1970. 1 fig, 68 ref.

Descriptors: *Halophytes, *Salt tolerance, *Reproduction, *Plant growth, *Reviews, Ecology, Arid lands, Salt marshes, Marine plants, Estuarine environment, Coastal marshes, Mangrove swamps, Osmotic pressure, Toxicity, Plant groupings, Plant physiology, Environmental effects, Ecosystems, Saline soils, Saline water, Xerophytes.
Identifiers: *Glycophytes, *Angiosperms.

All growing plants require at least some salts, but the literature on halophytes has failed to establish definitive criteria on the basis of absolute salt level requirements. Three types of halophyte are considered: (1) intolerant-grows in a 0.1% or less saline medium and growth declines as salinity increases; (2) facultative-optimal growth at moderate salinity (greater than 0.2%) and growth declines on both sides of the optimal level and (3) obligate-optimal growth at moderate and high salinities with declining growth as salinity decreases. The existing literature, incorporating both field and lab data, offers few thorough studies as guidance in determining the existence and relative distribution of these categories. Studies are either insufficient involving only short-term effects, or they ignore interacting variables such as salt toxicity and osmotic effects. Reproduction is also neglected, which is critical, since ability to reproduce rather than short-term growth should be the main criterion of salt tolerance. The literature is reviewed on marine angiosperms, mangroves, coastal strand plants, desert plants and salt marsh plants. Although some plants are demonstrably facultative halophytes, there is no hard evidence for the existence of any obligate halophytes. (Casey-Arizona)
W71-01714

CAN THERE BE A POSITIVE WATER POTENTIAL IN PLANTS,
Arizona Univ., Tucson. Dept. of Biological Sciences.
James W. O'Leary.
BioScience, Vol 20, No 15, p 858-859, 1 August 1970. 7 ref.

Descriptors: *Water balance, *Osmotic pressure, *Turgidity, *Soil-water-plant relationships, Xylem, Roots, Vascular tissues, Soil water, Transpiration, Exudation, Plant physiology, Circulation (Plants), Movement, Mode of action, Water circulation.
Identifiers: *Water potential, *Root pressure, *Guttation.

Investigators have recently allowed for the possibility of a positive plant water potential. In asserting that this is impossible, the author examines 3 situations in which it would be most likely to occur. High root pressures often result in exudates from cut stumps or leaf margins. This does not imply a positive water potential because water movements across the root occur in response to the higher osmotic pressure of the xylem fluid. If the roots were in pure free water, there would be a flow down a potential gradient into the xylem fluid until turgor pressure equalled osmotic pressure. The water potential would then be zero and flow would cease, preventing the attainment of a positive water potential. The possibility of an 'active pump' in the roots is considered and discarded for lack of evidence. The last possibility is the removal of salts in the sap stream, but this will be accompanied by water diffusion into living cells along the pathway. In any case the upper limit for plant water potential is set by soil water potential which should never be greater than zero in the vicinity of the roots. (Casey-Arizona)
W71-01718

MICROCLIMATE BEFORE AND AFTER IRRIGATION,
Washington Univ., Seattle. Coll. of Forest Resources.
Leo J. Fritschen, and Paul R. Nixon.
AAAS, Section on Applications of Ground Level Climatology, Annual Meeting, Berkely, Calif., Dec 27-30, 1965, paper presented. American Association for the Advancement of Science, Washington D.C., Publication No 86, p 351-366, 1967. 4 fig, 9 tab, 14 ref.

Descriptors: *Microclimatology, *Vapor pressure, *Solar radiation, *Arid lands, *Irrigation effects, On-site investigations, Heat budget, Thermal stratification, Latent heat, Evaporation, Advection, Convection, Arizona, California, Temperature, Soil surfaces, Turbulent boundary layers, Infrared radiation, Soil-water-plant relationships, Soil temperature, Root systems, Air temperature, Dew point, Humidity, Reservoirs, Energy balance, Sampling, Irrigated lands, Surface waters, Radiation.
Identifiers: *Potential evapotranspiration, *Point samples, *Transects, *Air space, *Sensible heat, Soil heat flux, USSR, Net radiation, Water surfaces, Oases, Salt River Valley (Ariz).

Irrigation effects on arid zone microclmates involving energy balance, vapor pressure and temperature were determined by field investigations and literature reviews of large and small irrigation oases in the U.S. and USSR. Both point sampling and transect methods were used. Energy balance components on an experimental field (73x92m) in the Salt River Valley, Arizona, were measured over open water and wet and dry bare soil. Evaporation from wet bare soil exceeded that from open water due to a greater surface-to-air vapor pressure gradient. In both large and small irrigated areas the microclimate is locally modified, the air being cooler and more humid to about 1.5m above ground surface. In supporting evaporation, irrigated areas utilized solar radiation and also extracted energy from local air masses. Due to vertical energy gradients, advection in arid lands is minimal. The various effects of irrigation are therefore compensatory and of limited areal extent and duration. These data were supported by results from a transect area in the San Joaquin Valley, California. The measured energy balance components may be used to calculate potential evapotranspiration which is useful in planning irrigation developments. (Casey-Arizona)
W71-01720

STATUS OF RESEARCH AND EDUCATION IN FOREST HYDROLOGY,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
William E. Sopper.
In: The Progress of Hydrology, Vol 2 - Specialized Hydrologic Subjects, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 744-776, published by Univ of Illinois, 1969. 33 p, 2 fig, 2 tab, 40 ref. OWRR Project A-006-PA.

Descriptors: *International Hydrological Decade, Conferences, *Education, *Forestry, *Forest management, Research and development, Water resources development, Forecasting, Hydrology, Hydraulics, Water Yield improvement, Conservation, Hydrogeology, Planning, Projects, Research facilities, Exploration, Economics, Evapotranspiration, Laboratories, Model studies, Technology, Computers, Instrumentation.
Identifiers: *Water resources research, *Forest hydrology.

There are about 650 million acres (260 million ha.) of forest land in the contermineous United States, representing slightly more than one-third of the total area. It is estimated that these forested areas receive well over one-half the total precipitation falling in the United States and may contribute nearly three-fourths of the total streamflow in this country. Much of the forest occupies rugged mountainous areas which under misuse or poor management can lead to disastrous results as evidenced by the disappearance of past civilizations due to their failure to recognize the importance of the forested watershed, its vegetative cover, and its hydrologic behavior. Much of the husbandry of our forests and wildlands, which produce most of the Nation's total streamflow, is entrusted to professional resource managers, primarily foresters and range managers. Response to the need for additional academic training in the water resource field is shown by the large increase in formal courses related to watershed management. Graduate programs in forest hydrology through the doctorate degree are now available at almost one-half of the accredited forestry schools. Almost all of these programs are inter-disciplinary and in addition to the water-related courses offered in the forestry school also generally require courses of civil engineering (hydrology and hydraulics), soil science (agronomy), geology and hydrogeology, meteorology and hydrometeorology, botany (plant physiology), and geography (climatology). Broad-based programs may even include course in natural resource management, land-use planning, water law, and natural resource economics. (Knapp-USGS)
W71-01829

MICROBIAL DEGRADATION OF ORGANIC POLLUTANTS OF INDUSTRIAL ORIGIN,
Massachusetts Univ., Amherst.
For primary bibliographic entry see Field 05C.
W71-01898

CONSUMPTIVE USE OF WATER BY SUGARCANE IN HAWAII,
Hawaii Univ., Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 02D.
W71-01902

2J. Erosion and Sedimentation

RELATIVE EFFECT OF WAVES GENERATED BY LARGE SHIPS AND SMALL BOATS IN RESTRICTED WATERWAYS,
California Univ., Berkeley, Hydraulic Engineering Lab.
For primary bibliographic entry see Field 08B.
W71-01664

CONTINUED EVALUATION OF ROADSIDE DEVELOPMENT AND EROSION CONTROL EXPERIMENTS. PART I. CAUSES AND CONTROL OF SOIL EROSION ON OKLAHOMA HIGHWAYS. PART II. MAINTENANCE OF VEGETATIVE GROUND COVERS ON OKLAHOMA HIGHWAYS. PART III. WEED CONTROL AND ERADICATION ON OKLAHOMA HIGHWAYS,
Oklahoma Agricultural Experiment Station, Stillwater.
For primary bibliographic entry see Field 04C.
W71-01681

EOLIAN SEDIMENT INFLUENCE ON PEDOGENESIS DURING THE QUATERNARY,
Wisconsin Univ., Madison. Department of Soil Science; Chicago Univ., Ill.; and California Univ., Riverside. Dept. of Geological Sciences.
For primary bibliographic entry see Field 02G.
W71-01709

OPEN CHANNEL EXPANSIONS FITTED WITH LOCAL HUMP,
Sir George Williams Univ., Montreal (Quebec); And Indian Inst. of Science, Bangalore.
For primary bibliographic entry see Field 08B.
W71-01731

SOME MORPHOMETRICAL RELATIONSHIPS IN THE MIDDLE AND LOWER REACHES OF THE AMU DARYA,
Sredneazuatsjuu Bauchno-Issledovatelskii Institut Irrigatsii, Tashkent (USSR).
For primary bibliographic entry see Field 08B.
W71-01779

MORPHOLOGICAL PRINCIPLE OF MODELLING RIVER-BED PROCESS,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 08B.
W71-01780

A BASIC CAUSE OF A BRAIDED CHANNEL,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
H. W. Shen, and S. Vedula.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 5-1 (Seminars), Science Council of Japan, Kyoto, p 201-205, 1969. 5 p, 1 fig, 1 ref. NSF Research Grant GK-0549.

Descriptors: *Sediment transport, *Alluvial channels, *Braiding, *Hydraulic models, Deposition (Sediments), Meanders, Sedimentation, Bed load, Provenance, Channel morphology, Discharge (Water), Sediment load, Sediment discharge.
Identifiers: Braided channels.

Based on the considerations of bank erosion and sediment transport, it is shown that in an aggrading channel, the shear stress can actually decrease with time. If there is no sediment supply from upstream, the channel may attain stability with no transport taking place in it. However, if there is sediment supply at the upstream end, the channel may widen so much and the depth may become so shallow that the flow cannot take place in a single channel, thus developing a tendency to braid. This can be a possible cause for the formation of a braided channel (or river). This hypothesis was tested and verified in a small laboratory channel. (Knapp-USGS)
W71-01781

SIMULATION OF RIVER BED VARIATION IN MOUNTAINOUS BASIN,
Osaka Univ. (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02A.
W71-01782

ON THE GEOMETRICAL CHARACTERISTICS OF SAND WAVES,
Kyoto Univ. (Japan). Disasters Prevention Research Inst.
For primary bibliographic entry see Field 08B.
W71-01783

CHANGES OF TOP-SET-BED IN A SILTED RESERVOIR,
Nagoya Univ. (Japan). Dept. of Civil Engineering.
Shohei Adachi, and Tatsuaki Nakatoh.
In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 5-1 (Seminars), Science Council of Japan, Kyoto, p 269-272, 1969. 4 p, 5 fig.

Descriptors: *Reservoir silting, *Sedimentation, *Sediment transport, Theoretical analysis, Equations, Streamflow, Channel morphology, River beds, Sediment load, Particle size, Flow rates, Diffusion.
Identifiers: *Top-set-bed, *Japan.

A simple equation has been derived for river bed variation by neglecting the rate of changes of flow in time and space. The diffusion coefficient value may be understood as an index of dominant discharge for the river. The method is found to be a useful tool for determination of the top-set-bed in natural rivers in an extended period. (Woodard-USGS)

W71-01785

VARIATION OF ROUGHNESS DURING DEGRADATION,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W71-01786

COMPUTATION OF DOMINANT DISCHARGE,
Gifu Univ. (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W71-01787

PROBLEMS OF TWO-PHASE FLOW THEORY,
Novosibirsk State Univ. (USSR).
For primary bibliographic entry see Field 08B.
W71-01789

EFFECTIVE GRAIN-SIZE IN SEDIMENT TRANSPORT,
Florida Univ., Gainesville. Dept. of Civil Engineering.
B. A. Christensen.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 223-231, 1969. 9 p, 3 fig, 6 ref.

Descriptors: *Sediment transport, *Particle size, Tides, Shear stress, Tractive forces, Flow resistance, Turbulence, Sediments, Scour.
Identifiers: Effective grain-size.

Effective grain-size of a nonuniform natural sediment was defined and analytically determined for use in problems related to transport of sediments by tidal motion and moving water in general, with critical bed shear stresses. It is demonstrated that the same effective grain size may be used in all cases. A general formula was developed for its determination when the grain-size distribution curve is known. Evaluation is simplified by approximating the grain-size distribution curve by a series of straight lines. The influence of Hazen's uniformity coefficient on effective grain size is studied. Of particular interest is the fact that effective grain size never exceeds d50% and never is less than d10%. (Knapp-USGS)
W71-01791

DEEPENING THE APPROACH CHANNEL TO THE PORT OF COCHIN, INDIA,
Central Water and Power Research Station, Poona (India). Tidal Hydraulics Div.
For primary bibliographic entry see Field 08B.
W71-01792

SALINITY VARIATIONS, DENSITY CURRENTS, AND SILT TRANSPORT IN THE SAINT JOHN ESTUARY,
Bedford Inst., Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.
For primary bibliographic entry see Field 02L.
W71-01794

HYDRAULIC AND SEDIMENTARY PROBLEMS IN TIDAL ESTUARIES,
Laboratorio Nacional de Engenharia Civil, Lisbon (Portugal).
For primary bibliographic entry see Field 02L.
W71-01795

HYDROGRAPHIC CHANGES IN THE EDINBURGH CHANNELS, OUTER THAMES ESTUARY, U.K.,
Bedford Coll., London (England).
For primary bibliographic entry see Field 02L.
W71-01796

SALINITY EFFECTS ON ESTUARINE HYDRAULICS AND SEDIMENTATION,
Army Engineer Waterways Experiment Station, Vicksburg, Miss. Hydraulics Div.
For primary bibliographic entry see Field 02L.
W71-01813

THE MECHANICS OF SUSPENDED SEDIMENT DUE TO WAVE ACTION,
Chuo Univ., Tokyo (Japan). Dept. of Civil Engineering.
Masataro Hattori.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 399-406, 1969. 8 p, 6 fig, 1 photo, 2 tab, 10 ref.

Descriptors: *Suspended load, *Standing waves, Waves (Water), Sediment transport, Turbulence, Turbulent flow, Diffusivity, Diffusion, Model studies, Hydraulic models.
Identifiers: Wave flumes.

A theory is presented for the distribution pattern of sediment concentration due to standing waves. The theoretical development introduces a delay distance between the sediment concentration and the water particle velocity, and assumes that the coefficient of diffusion is constant. A fairly good agreement is shown in comparison between the theory and experiments with respect to horizontal and vertical distributions of sediment concentration. The experiment was made in a two dimensional wave flume. Sediment concentration was measured with a instrument by which numbers of sediment particles in supsension were counted. (Knapp-USGS)
W71-01814

SEDIMENTATION PROCESSES AS PART OF HYDROLOGY,
Arizona Univ., Tucson. Dept. of Civil Engineering.
Emmett M. Lautsen.
In: The Progress of Hydrology, Vol 2 - Specialized Hydrologic Subjects, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 737-743, published by Univ of Illinois, 1969. 7 p 1 append.

Descriptors: *International Hydrological Decade, Conferences, *Education, *Sedimentation, *Sediment transport, Research and development, Water resources development, Hydrology, Hydraulics, Planning, Projects, Research facilities, Laboratories, Model studies, Technology, Computers, Instrumentation.
Identifiers: *Water resources research.

Education in sedimentation for professional hydrologists is reviewed and suggestions are made for its improvement. The fundamental processes of sedimentation which the student must first understand as well as they are known are: under what conditions sediment particles begin to be moved by flowing water; how, and how much, bed load will be moved along by the flowing stream; how the bed material becomes suspended in the flow; how the sediment particles will be distributed throughout the suspension; what the bed form will be; and under what conditions the sediment particles will stop moving. Secondly, the student should start to get some appreciation for how he will have to apply his understanding of the fundamental sedimentation processes to real situations in which a prediction must be made as to what will happen under certain circumstances. Another reason sedimentation should be included in hydrology is that the stream and its valley are the consequence of the past history of the sedimentation processes. Thus to understand stream behavior, it is advantageous to understand why the stream is what it is. (Knapp-USGS)
W71-01828

GEOMORPHOLOGY,
Illinois Univ., Urbana. Dept. of Mining, Metallurgy and Petroleum Engineering.
Adrian E. Scheidegger.
In: The Progress of Hydrology, Vol 2 - Specialized Hydrologic Subjects, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 777-786, published by Univ of Illinois, 1969. 10 p, 1 fig, 12 ref. NSF Grant No GK-1186.

Descriptors: *International Hydrological Decade, *Conferences, *Geomorphology, *Stochastic processes, Erosion, Sedimentation, Water resources development, Forecasting, Hydrology, Hydraulics, Topography, Open channel flow, Alluvial channels, Drainage patterns (Geologic), Statistical models, Computers, Instrumentation.
Identifiers: *Water resources research.

The roles of geomorphology in hydrology and in the education of hydrologists are reviewed. Geomorphology is the science of the development of landscapes. Most of the appearance of a landscape is due to the action of water. The deterministic approach is not very practicable. There are too many individual soil particles and complex processes which have to be kept track of to accomplish present scientific means. The first steps in the statistical treatment of land-forming processes were taken by Leopold and Langbein, who noted an analogy between certain features of landscape development and thermodynamic principles, notably an analogy with the concept of entropy. The general idea of treating landscape development as a stochastic process can be applied to the theory of river meanders and the theory of drainage basin development. (Knapp-USGS)
W71-01830

SEAMAP DEEP-SEA CHANNEL,
Pacific Oceanographic Lab., Seattle, Wash.
For primary bibliographic entry see Field 07C.
W71-01919

EXPERIMENTAL STUDIES OF FLOWS WITH HIGH SOLID PARTICLE CONCENTRATIONS,
For primary bibliographic entry see Field 08B.
W71-01920

SUSPENDED LOAD TRANSPORT IN SWISS RIVERS (FRENCH),
Daniel Bonnard, and Jacques Bruschin.
In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2 (Subject B), Science Council of Japan, Kyoto, p 91-109, 1969. 19 p, 10 fig.

Descriptors: *Sediment transport, *Sediment load, *Rivers, *Sediment discharge, *Suspension, Foreign projects, Running waters, Sediments, Particle size, Sampling.
Identifiers: *Swiss Rivers, *Minimum sampling frequencies.

Suspended-sediment concentration measurements were made in Swiss Rivers to produce a basis for rules to be applied in selecting sampling points or verticals in order to get a reliable determination of suspended-sediment discharge from a limited number of samples. It was found that suspended-sediment load and size, water discharge, and water temperature vary in a somewhat parallel manner as well during the daily cycles as during floods. Graphs relating the results of the basic data determinations and suggestions for sampling time-tables, are presented. (Woodard-USGS)
W71-01921

MECHANICS OF TURBULENT FLOW IN SEDIMENT-LADEN STREAMS,
Universidad Central de Venezuela, Caracas. Dept. of Engineering.
Anatol Zagustin, and Konstantin Zagustin.

French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2 (Subject B), Science Council of Japan, Kyoto, p 317-324, 1969. 8 p, 2 fig, 8 ref.

Descriptors: *Sediment transport, *Turbulent flow, *Mathematical studies, *Sediment distribution, *Streams, Channel morphology, Flow rates, Particle size, Flow resistance, Foreign projects.
Identifiers: *Theoretical curve, *Caracas (Venezuela).

A theoretical curve for relating distribution of suspended sediment in turbulent flowing streams is presented. The presence of solid particles with a given fall velocity affects the momentum equation and produces an additional term in the expression for the turbulent shear, which is proportional to the sediment concentration. The equation for the turbulent shear is used to study the effect of sediment on the mean slope of the velocity distribution in the stream, and an analytical expression is obtained as a function of a non-dimensional parameter which contains the basic flow variables. The curve is compared with different experimental data for laboratory flumes and rivers with satisfactory results. (Woodard-USGS)
W71-01923

TRANSPORT CAPACITY OF TURBULENT TWO-PHASE FLOW,
Institut za Vodoprivredu Jaroslav Cerni, Belgrade (Yugoslavia).
Stevan Bruk, and Vera Miloradov.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2 (Subject B), Science Council of Japan, Kyoto, p 357-369, 1969. 13 p, 4 fig, 1 tab, 13 ref.

Descriptors: *Sediment transport, *Sediment distribution, *Stratified flow, *Turbulent flow, *Mathematical studies, Streams, Channel morphology, Flow rates, Particle size, Flow resistance, Foreign projects.
Identifiers: Belgrade (Yugoslavia).

Mathematical expressions relating transport of suspended solid particles in turbulent flow are described. The transport capacity coefficient is identified as a Richardson number, representing a parameter of dynamical similarity of flow. The structure of this coefficient is analyzed and related to field investigations conducted on a sediment-carrying river. Correlations were established between the transport of suspended load and flow characteristics. (Woodard-USGS)
W71-01925

REPRESENTATION OF NON-GRANULAR BOUNDARIES IN HYDRAULIC MODELS,
Department of State Hydraulic Works, Ankara (Turkey). Research Section.
For primary bibliographic entry see Field 08B.
W71-01927

POLYPHASE CURRENTS WITH NONUNIFORM SEDIMENTS AND THE PHYSICS OF RIVER FLOW,
I. Egiazaroff.
French summary. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2 (Subject B), Science Council of Japan, Kyoto, p 165-175, 1969. 11 p, 3 fig, 22 ref.

Descriptors: *Sediment transport, *Rivers, *Erosion, *Streamflow, *Currents (Water), Flow rates, Channel morphology, Topography, Watersheds (Basins), Particle size, Floods, Sediment distributions, Equations, Foreign projects.
Identifiers: *USSR.

Characteristics of sediment transport under polyphase conditions of watershed topography, channel morphology, streamflow and particle size are interpreted with equations and graphs from data available for 58 rivers in the USSR. Motion of turbulent river flow is divided into two classes--torrential sediment flow, when all sediment sizes are in motion and channel surfaces are eroded; and nontorrential sediment flow, when the channel surface is built up and larger particles are at rest and sheltering smaller particles. Suspended load and increasing turbidity are illustrated by Shagap River (83 sq km in Armenian SSR) where a flow of only 1.9 cms carries a suspended load of 277 grams per liter. Rivers of the Amu-Daria Watershed in middle Asia, which carry large quantities of fine sand and mud, show relationships of mud load, mean velocity, depth, and sediment free fall velocity. (Lang-USGS)
W71-01929

THE EFFECT OF BED FORMS ON THE HYDRAULIC RESISTANCE,
Middle East Technical Univ., Ankara (Turkey). Dept. of Civil Engineering and Lehigh Univ., Bethlehem, Pa. Fritz Engineering Lab.
For primary bibliographic entry see Field 08B.
W71-01931

DISTRIBUTION OF SUSPENDED MATTER AND SIMILARITY CRITERIA IN SETTLING BASINS,
Technical Univ. of Istanbul (Turkey). Dept. of Hydraulic and Water Power.
For primary bibliographic entry see Field 08B.
W71-01937

THE TURBULENCE WITH FINE PARTICLES IN UPWARD FLOW,
Kyushu Univ., Fukuoka (Japan). Dept. of Civil Engineering.
Yoichi Awaya, and Tetsuya Kusuda.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2 (Subject B), Science Council of Japan, Kyoto, p 203-210, 1969. 8 p, 2 fig, 2 tab, 6 ref.

Descriptors: *Sedimentation, *Turbulence, *Flocculation, *Fine aggregates, *Anemometers, Gravity, Flow, Velocity, Model studies, Mathematics, Equations, Sediments, Particle size, Specific gravity, Foreign projects.
Identifiers: *Upward flow, *Japan.

The energy spectrum related to turbulence resulting from the settling of particles is measured with a hot wire anemometer developed in the authors' laboratory. It has been clarified that the acceleration of gravity and drag force are predominant and the value of inertia term is negligible in the turbulence resulting from the settling of particles. Many errors resulted by applying the hot wire anemometry to the measurement of turbulence with rigid particles. Related equations, graphs, and tables of data are included. Many theoretical and experimental studies have been reported concerning turbulence resulting from friction in the bed with suspended particles. This investigation determines that the theoretical analysis of turbulent flow with suspended particles can be classed as polyphase flow. (Woodard-USGS)
W71-01938

ON THE MECHANICS OF SALTATION OF A SPHERICAL SAND PARTICLE IN A TURBULENT STREAM,
Kyoto Univ. (Japan). Disasters Prevention Research Inst.
Yoshito Tsuchiya.
French summary. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2 (Subject B), Science Council of Japan, Kyoto, p 191-198, 1969. 8 p, 5 fig, 1 photo, 9 ref.

Descriptors: *Sediment transport, *Saltation, *Turbulent flow, *Sands, *Theoretical analysis, Particle size, Particle shape, Specific gravity, Dynamics, Streams, Flow rates, Velocity, Turbulence, Equations, Channel morphology, Foreign projects.
Identifiers: *Sand particle, Sliding motion, Rolling motion, Angular motion, Kyoto (Japan).

In order to establish the mechanics of sediment transport, a theory about the saltation of a single sand particle from the beginning of movement in a turbulent stream is described, based on the mechanism of rolling motion and collision of the rolling sand particle with a bed sand particle. It was concluded that the theoretical relationships of the rolling velocity, the rolling distance and distributions, and the characteristics of the saltation height and distributions are in fairly good agreement with the experimental values. (Woodard-USGS)
W71-01939

RESEARCH OF THE SOLID-LIQUID FLOWS WITH HIGH CONSISTENCE,
Akademiya Nauk URSR, Kiev.
For primary bibliographic entry see Field 08B.
W71-01952

THE STRUCTURE OF NATURAL TURBULENT SEDIMENT-LOADED STREAMFLOW,
Gidrometeorologicheskii Institut, Odessa (USSR).
D. I. Grinvald.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2, (Subject B), Science Council of Japan, Kyoto, p 251-259, 1969. 9 p, 3 fig, 6 ref.

Descriptors: *Sediment transport, *Turbulence, *Natural flow, *Rheology, *Statistical methods, Channel morphology, Mathematics, Equations, Computers, Suspended load, Sediment load, Particle size, Flow rates, Velocity, Sediment distribution, Foreign projects.
Identifiers: *USSR.

Statistical characteristics of suspended load concentration in natural turbulent streamflow are presented. Data are included on the energy spectrum of streamflow turbulence, the dissipation of turbulent energy and the turbulence scale. Within a certain frequency sector an 'inertia interval' takes place. Autocorrelative, structural and spectral functions of the concentration parameter were computed and agree with similar velocity functions. A coincidence of the spectral functions of velocity and concentration is evident for the high-frequency sector of the spectrum. In accordance with the diffusion conception, the actual distribution of suspended particles approaches the theoretical one. (Woodard-USGS)
W71-01955

LAMINAR FLOW OF SAND-WATER SUSPENSIONS,
Indian Inst. of Tech., Kanpur. Dept. of Civil Engineering.
K. Subramanya.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2, (Subject B), Science Council of Japan, Kyoto, p 221-231, 1969. 11 p, 7 fig, 11 ref.

Descriptors: *Laminar flow, *Sediment transport, *Sands, *Water, *Suspension, Theoretical analysis, Mathematics, Equations, Channel flow, Flow rates, Rheology, Gravity, Sediment distribution, Streambeds, Particle size, Suspended load, Foreign projects.
Identifiers: *India.

The rheological behavior in laminar flow of sand-water suspension was investigated by using a capillary viscometer. The suspension was found to behave as a non-Newtonian dilatant fluid over the

range of shear rates tested. Bagnold's concept of grain shear stress and linear concentration are used to analyze the data. A critical concentration at which there is an abrupt change in characteristics of suspension is noticed at concentrations between 0.30 and 0.35 microns. (Bagnold showed by momentum analysis that between successive layers of a suspension of spheres there exists a shear stress which is in addition to any shear stress necessary for motion of fluid only.) Similar results to Bagnold's experimentally derived curve indicate that the dimensionless terms used are meaningful. (Woodard-USGS)
W71-01956

THE CHARACTERISTICS OF FLOW WITH WASH LOAD,
Tokyo Inst. of Tech. (Japan). Dept. of Civil Engineering.
Hideo Kikkawa, and Shoji Fukuoka.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2, (Subject B), Science Council of Japan, Kyoto, p 233-240, 1969. 8 p, 4 fig, 1 tab, 6 ref.

Descriptors: *Sediment transport, *Sediment load, *Flow characteristics, *Model studies, *Turbulent flow, Alluvial channels, Scour, Flow rates, Sediments, Bed load, Suspended load, Movement, Particle size, Running waters, Sedimentation rates, Settling velocity, Specific gravity, Flumes, Foreign projects.
Identifiers: *Wash load.

When suspended bed-material sediment is transported in a given hydraulic condition, it is important to understand what changes take place in the water and sediment flow due to the wash load added to the flow. The following conclusions were made from model studies at Tokyo Institute of Technology: (1) The behavior of wash load is almost the same as the behavior of suspended load; (2) an equation expressing the distribution of sediment concentration was derived and was verified to be reasonable by experimental data; (3) the wash load affects the concentration of bed material load and the transport rate; and (4) in some cases, the presence of wash load changes the feature of bed configuration in alluvial streams and thereby the flow resistance and the rate of sediment transport are affected considerably. Related graphs, equations, and tables of data are included. (Woodard-USGS)
W71-01957

THEORETICAL DESCRIPTION OF FREE SURFACE TWO-PHASE FLOW OVER A WAVY BED,
Universidad Central de Venezuela, Caracas. Hydraulics Lab.
For primary bibliographic entry see Field 08B.
W71-01962

EROSION CONTROL ON HIGHWAY RIGHTS-OF-WAY IN ARKANSAS,
Arkansas Univ., Fayetteville. Dept. of Agronomy.
A. E. Spooner, and C. L. Murdoch.
Available from NTIS as PB-194 017, $3.00 in paper copy, $0.95 in microfiche. Highway Research Project No 15 Final Report, June 1970. 156 p, 82 tab, 7 fig.

Descriptors:
Identifiers: *Highways, *Erosion control, Vegetation, Grasses, Herbicides, Limestone, Fertilizers, Moisture, Mulches, Arsenic organic acids, Arsenates, Soil, Maintenance, Costs, Effectiveness, Arkansas, *DSMA herbicide, *Highway rights of way, Methane arsonic acid, Acetic acid/2-4-dichlorophenoxy.

Materials and methods for establishment, maintenance and control of vegetation were investigated. Laboratory and field experiments indicate that a straw and/or wood celluose fiber mulch is essential for establishment of vegetation. Prevention of erosion and maintenance of necessary moisture relationship are the principal factors. The need for adequate fertility following seeding and for maintaining nutrient levels were investigated. Original applications of 800 lbs/acre of 10-20-10 with 2 to 3 year repeat applications of 500-700 lbs/acre are recommended. Two to four tons of agricultural limestone or dicalcium silicate should be applied initially. Tall fescue, common bermudagrass, weeping lovegrass and bahiagrass are the most adaptable grass species for highway use in Arkansas. Effective vegetation control with 2,4D can eliminate weeds and reduce or eliminate expensive mowing operations on some areas. Greenhouse and field experiments with maleic hydrazide as a growth retardant proved effective. Johnsongrass can be effectively controlled with 2 to 3 applications of organic arsenical herbicided--DSMA (Disodium methylarsonate) MSMA (methanerarsonic acid)--at 2 to 4 lbs/acre. A method was developed to determine the mode of action of organic arsenical herbicides on Johnsongrass.
W71-02051

2K. Chemical Processes

EOLIAN SEDIMENT INFLUENCE ON PEDOGENESIS DURING THE QUATERNARY,
Wisconsin Univ., Madison. Department of Soil Science; Chicago Univ., Ill.; and California Univ., Riverside. Dept. of Geological Sciences.
For primary bibliographic entry see Field 02G.
W71-01709

THERMODYNAMIC EQUILIBRIUM CONSTANTS OF SODIUM-CALCIUM EXCHANGE IN SOME ISRAEL SOILS,
National and Univ. Inst. of Agriculture, Rehovoth (Israel). Volcani Inst. of Agriculture Research; and Hebrew Univ., Jerusalem (Israel).
For primary bibliographic entry see Field 02G.
W71-01717

TRITIUM HYDROLOGY OF THE TALLAHASSEE, FLORIDA AREA WITH ANALYSIS BY LIQUID SCINTILLATION COUNTING WITHOUT ISOTROPIC ENRICHMENT,
Florida State Univ., Tallahassee. Dept. of Geology.
Edward I. Wallick.
M.S. Thesis, Florida State University, December 1969. 110 p, 18 fig, 11 tab, 30 ref. OWRR Project A-011-FLA (6).

Descriptors: *Water chemistry, *Tritium, *Tracking techniques, *Florida, Radioactive dating, Mixing, Water sources, Groundwater, Recharge, Discharge (Water), Groundwater movement, Aquifers, Springs, Tracers, Hydrogeology, Artesian wells.
Identifiers: Tallahassee (Fla).

An inexpensive and simple method was developed for the analysis of low-level tritium in natural waters. The hydrogen of the water sample is associated with carbon to form acetylene during the hydrolysis of calcium carbide. The lower detection limit of the system is 8 Tritium Units, and activities of 50 Tritium Units may be detected within a statistical error of 10 percent. The method is suitable for measurement of tritium in rain, groundwater, and ocean water. In the western half of Leon County and eastern Gadsden County, Florida, the waters are pre-bomb, that is, older than 1952, and show little evidence of mixture with younger waters. Little, if any, lateral dispersion of waters occurs across the boundary zone. Flow is entirely from north to south along the eastern side of the boundary according to the peizometric surface. Mixing coefficients at Wakulla Springs during the dry season were estimated at 65 percent deep artesian water and 35 percent shallow ground and surface runoff water. (Knapp-USGS)
W71-01777

RESEARCH ON THE MARINE FOOD CHAIN. PROGRESS REPORT, JULY 1968-JUNE 1969, VOLUME 1. CHEMISTRY AND MICROBIOLOGY,
California Univ., San Diego, La Jolla. Inst. of Marine Resources.
For primary bibliographic entry see Field 05A.
W71-01885

THE APPLICATION OF PHASE SELECTIVE ALTERNATING CURRENT POLAROGRAPHY TO THE ANALYSIS OF HEAVY METALS IN WATER,
Georgia Inst. of Tech., Atlanta.
For primary bibliographic entry see Field 05A.
W71-01895

SPATIAL SPECTRA OF OCEAN SURFACE TEMPERATURE,
National Oceanic and Atmospheric Administration, Miami, Fla. Sea-Air Interaction Lab.
William McLeish.
Sponsored by Office of Naval Research. Journal of Geophysical Research, Vol 75, No 33, p 6872-6877, November 20, 1970. 6 p, 4 fig, 1 tab, 16 ref.

Descriptors: *Surface waters, *Oceans, *Temperature, Spectrometers, Wavelengths, Atmosphere, Density, Water circulation.
Identifiers: *Spatial spectra, *Ocean-Atmosphere temperature relationship.

One-dimensional variance spectra of radiometric ocean surface temperature are similar at small wave numbers to horizontal spectra within the upper ocean. The variance densities in both surface water and upper ocean water decrease continuously with increasing wave numbers. However, at great wave numbers the spectra within the water continue to decrease, but the surface spectra often become nearly constant. The additional variance density there is attributed to alteration of the surface temperature by patches of compacted organic films. This compaction is produced by convergences in the turbulence within the water. Thus small-scale temperature patterns on the ocean surface often represent only a superficial consequence of the water circulation rather than bulk temperature variations. (Woodard-USGS)
W71-01907

RAPID ANALYTICAL METHODS FOR THE INVESTIGATION OF METALS AND INORGANIC RAW MATERIALS. XII. DETERMINATION OF TRACE AMOUNTS OF BERYLLIUM IN MINERAL WATERS AND MINERALS,
California Univ., Livermore. Lawrence Radiation Lab.
Z. Sulcek, J. Dolezal, and J. Michal.
Available from NTIS as UCRL-TRANS-10443, $3.00 in paper copy, $0.95 in microfiche. January 70. 19 p.
Identifiers: *Beryllium, Chemical analysis, *Minerals, Beryllium, Ethylenedinitrilo tetraacetates, Chelate compounds, Czechoslovakia, *Morin, Flavones, *Fluorometric analysis.

A study was made of the sorption of beryllium onto silica gel from weakly acid, neutral, and weakly alkaline solutions. The addition of Complexon (EDTA) and tartrate makes the separation to a large extent selective, and with subsequent elution of the beryllium by hydrochloric acid it enables a straightforward determination of beryllium by the fluorometric technique using morin. The technique has been used for the determination of trace amounts of beryllium in mineral waters and minerals.
W71-01990

2L. Estuaries

MATHEMATICAL PROGRAMMING FOR REGIONAL WATER QUALITY MANAGEMENT,
California Univ., Los Angeles. Graduate School of Business Administration.
For primary bibliographic entry see Field 05G.
W71-01659

QUANITATIVE DISTRIBUTION OF BENTHIC MACROFAUNA IN THE BLACK SEA,
Naval Oceanographic Office, Washington, D.C.
For primary bibliographic entry see Field 05C.
W71-01683

BARRIER ISLANDS OF THE NORTHERN GULF OF MEXICO COAST: SEDIMENT SOURCE AND DEVELOPMENT,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
Hyuck J. Kwon.
Available from NTIS as AD-704 541, $3.00 in paper copy, $0.95 in microfiche. Technical Report No. 75, December 31, 1969. 51 p, 32 fig, 159 ref, 1 tab. ONR Contracts Nonr-1575 (03), Nonr-1575 (00).
Identifiers: *Seacoast, Mexico Gulf, *Islands, Sedimentation, Sources, Transport properties, Sand, Deposits, Estuaries, Geologic age determination, Deltas, Ocean waves, Tides, Florida, Littoral drift, Landforms, Barriers.

The evolution of barrier islands along the northern Gulf of Mexico coast is directly related to source of sediments and littoral processes. Johnson formulated his hypothesis on barrier island formation in 1919, and his theory prevailed for several decades. Johnson's theory resulted from consideration of only two dimensions normal to the coastline; a third, longshore drift, was not regarded as critical for the initiation of barrier island development. In this study, which is confined to the northern Gulf coast, major sources of sediment supply and transportation patterns of barrier forming sand were examined, along with results of recent oceanographic investigations in the Gulf of Mexico. This study is based on a comprehensive survey of the literature, maps, and marine charts, which were correlated with field observations. To obtain a perspective, only gross forms and processes of barrier development were considered. Evidence indicates that Santa Rosa, island, Mississippi Sound, and Bolivar Peninsula barriers developed downdrift of sediment-supplying coast of Quaternary age. These barriers evolved with the Recent rise of sea level to its present stand. Apalachicola barriers formed on the flanks of the Pleistocene deltaic plain. Coasts such as the stretch between Destin and Panama City, Florida, and the zero-energy coast of Florida do not have barrier islands. In these cases the modern shoreline is abutted against Pleistocene deposits which are the local source of sediments.
W71-01684

TEMPERATURE, DISSOLVED OXYGEN, TOTAL ALKALINITY, AND BIOCHEMICAL OXYGEN DEMAND IN THE COLUMBIA RIVER ESTUARY, 1966-67,
Bureau of Commercial Fisheries, Seattle, Wash. Biological Lab.
Carl W. Sims, and Carl J. Cederholm.
Available from NTIS as PB-189 503, $3.00 in paper copy, $0.95 in microfiche. Fish and Wildlife Service Data Report 43, January 1970. 32 p, 18 tab, 3 ref.
Identifiers: *Estuaries, Ecology, *Water pollution, Estuaries, Oxygen, pH, Bases (Chemistry), Temperature, Industries, Fishes, Columbia River estuary, Biochemical oxygen demand, Fisheries, Limnology.

Temperature, dissolved oxygen, total alkalinity, and biochemical oxygen demand collected at 19 locations in the Columbia River estuary are presented as a reference for researchers in fisheries or in water quality.
W71-01689

BENTHIC BIOMASS AND SURFACE PRODUCTIVITY,
Woods Hole Oceanographic Institution, Mass.
Gilbert T. Rowe.
Available from NTIS as NYO 3862-24, $3.00 in paper copy, $0.95 in microfiche. Contribution No. 2420, 1969. 22 p. Contract AT (30-1)-3862.
Identifiers: *Marine biology, *Ocean bottom, Aquatic animals, Plants (Botany), Surface properties, *Benthos, *Biomass.

Benthic samples from the north temperate Atlantic, the Gulf of Mexico, the Atlantic off Brazil, and the Pacific off Peru provided data for a comparison of animal densities and biomass under varying ecological conditions. The average biomass and the different rates of decrease in life with depth in different regions can be used to infer the magnitude of effects of surface production on the bottom fauna. These averages are significantly higher in regions of high primary productivity (New England and Peru) than where productivity is low (Bermuda, Brazil, and the Gulf of Mexico). The regression coefficients or rates of decrease in animal density were greatest where surface prductivity varied markedly in an offshore direction (Woods Hole and Brazil). Where productivity varied to a lesser degree (Peru, Gulf of Mexico, and Bermuda), the rates of decrease were reduced. These regressions suggest that while depth exerts the most stringent effects, surface productivity ranks second in controlling benthic biomass. In the upwelling region off Peru, the hydrography and associated high productivity have caused marked oxygen depletion in sediments and bottom water. The result is a numerically dense fauna of low biomass and diversity where the oxygen minmum zone impinges on the bottom, and a diverse community of high biomass in deeper water offshore. In this situation, the effects of productivity on benthic biomass are more pronounced than depth, and rather than ameliorating benthic production, have inhibited it.
W71-01697

BOTTOM TOPOGRAPHY AND SEDIMENT TEXTURE NEAR THE COLUMBIA RIVER MOUTH,
Washington Univ., Seattle. Dept. of Oceanography.
Dean A. McManus.
Available from NTIS as PB-193 298, $3.00 in paper copy, $0.95 in microfiche. 1970. 24 p, 2 tab, 8 ref. AEC AT (45-1)-1725.
Identifiers: *Continental shelves, Ocean bottom topography, *Rivers, Sedimentation, Deposits, Silt, Sand, Seacoast, Erosion, Beaches, Harbors, Pacific Ocean, Columbia River, Willapa Canyon, Willapa Bay, Topographic relief, Continental slopes, Submarine canyons.

The shelf topography and sediments near the mouth of the Columbia River can be grouped into six units: (1) rough topography of relict sediments, (2) outer shelf silty sand, (3) inner shelf sand wedge, (4) nearshore sand, (5) Columbia River silt deposit, and (6) shelf-break sand. Each unit is characterized by certain aspects of the topographic relief or gradient and by the distribution of sediment texture.
W71-01698

MACROPHYTES OF THE SAKHALIN SEA COAST,
Naval Oceanographic Office, Washington, D.C.
V. B. Vozzhinskaya.
Available from NTIS as AD-704 668, $3.00 in paper copy, $0.95 in microfiche. Trans. from Trudy Inst. Okeanologii, Vol 69, p 330-441, 1964. Naval Oceanographic office, Translation 462, 1969. 139 p.
Identifiers: *Algae, *Ecology, Distribution, Classification, Marine biology, Ocean bottom sampling, Geography, USSR, Translations, Sakhalan Sea.

The marine bottom flora of Sakhalin was studied. One hundred and sixty-five (165) species of the algae flora were observed; forty-seven (47) species are new to Sakhalin, and 5 species are new to science. Altogether there are 286 species of algae, 50 species belong to Chlorophyccac, 90 to Phacophyccac, 146 to Rhodophyccac orders. Phytogeographically, the algae of Sakhalin are of different origin. A comparison of the algal flora of Sakhalin with other regions of the North Pacific shows that the algal flora of Sakhalin constitutes a phytogeographical boundary between the algal flora of the warm-water and cold-water regions of the North Pacific. The closest relationship exists between the algal flora of Sakhalin and Hokkaido. The vertical and horizontal distribution is diverse in supralitoral, litoral, upper sublitoral zone. This distribution depends on the bottom structure, the wave action, the height and mode of the tide. Only 75 species of all Sakhalin algae are abundantly distributed. The distribution of biomasses varies from area to area. A number of algae can be used for food or for other puroposes. Data on the distribution and crop of algae within Sakhalin are given in this study.
W71-01699

COASTAL/ESTUARINE POLLUTION, AN ANNOTATED BIBLIOGRAPHY,
Ocean Engineering Information Service, La Jolla, Calif.
For primary bibliographic entry see Field 05C.
W71-01788

PROGRESSIVE SALINITY INTRUSION DURING THE DRY SEASON IN THE HOOGHLY ESTUARY, INDIA,
Central Water and Power Research Station, Poona (India).
C. V. Gole, and V. S. Thakar.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 275-282, 1969. 8 p, 5 fig, 1 tab, 4 ref.

Descriptors: *Saline water intrusion, *Estuaries, *Streamflow, Mixing, Tidal effects, Tides, Discharge (Water), Water supply, Water quality, Mathematical models, Model studies, Convection, Diffusion, Dispersion, Salinity, Saline water systems.
Identifiers: Hooghly estuary (India).

Freshwater flows into the Hooghly estuary are confined to the four months from July to October. The discharge reaches maximum values of the order of 3,000 cu m/s. There is practically no upland flow during the remaining period of the year. The river salinities, which are almost nil during and just after a freshet season, rise steadily through the dry season owing to the tidal action. The dry season salinity intrusion seriously affects the supply of drinking water to the city of Calcutta. Analysis of the intrusion phenomenon over a tidal cycle yields a distribution which is the same from one tidal cycle to another. An analytical model is developed from the basic convective diffusion equation to describe the mean space-time salinity distributions over long periods of time in the Hooghly. (Knapp-USGS)
W71-01793

SALINITY VARIATIONS, DENSITY CURRENTS, AND SILT TRANSPORT IN THE SAINT JOHN ESTUARY,
Bedford Inst., Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.
H. A. Neu.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 241-248, 1969. 8 p, 8 fig, 5 ref.

Descriptors: *Sediment transport, *Saline water intrusion, *Estuaries, Silting, Sedimentation, Saline water-freshwater interfaces, Mixing, Flow, Tides,

Tidal effects, Bores, Stratified flow, Unsteady flow, Density currents.
Identifiers: St. John Estuary (Canada), Bay of Fundy.

Most of the mixing between fresh and salt water in the Saint John River of Eastern Canada is confined to a short reach near the mouth of the estuary due to a natural constriction in the river channel which acts as a salinity barrier and as an impediment to tide propagation. The constriction causes cyclic outflows and inflows of fresh and salt water, creating a highly variable density regime in which the flow is both unsteady in time and non-uniform spatially. During a tide cycle, there are two principal flow systems, a two-layer system having opposite moving currents and large salinity gradients and a single layer unidirectional system with small salinity gradients. Good agreement was obtained between theory and observations with regard to the interfacial Froude number, the freshet ebb tide discharge during which the salt water is washed away from the mouth of the river, the length of the saline wedge, the critical interfacial velocity and the rate of entrainment from the undiluted saline lower layer into the upper layer. Bed currents transport some silt back into the mouth of the river from where it is washed over the 'Reversing Falls' into the lake-like river system where part of it forms an inverse delta. (Knapp-USGS)
W71-01794

HYDRAULIC AND SEDIMENTARY PROBLEMS IN TIDAL ESTUARIES,
Laboratorio Nacional de Engenharia Civil, Lisbon (Portugal).
Fernando M. Adecasis.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 249-256, 1969. 8 p, 5 fig, 4 ref.

Descriptors: *Estuaries, *Sediment transport, *Tides, *Tidal effects, Sedimentation, Channel morphology, Currents (Water), Bed load, Suspended load, Sand bars, Provenance, Hydraulics, Reviews.
Identifiers: Hydraulics of estuaries.

The hydraulic and sedimentary factors influencing shape and depth of the inner and outer channels in tidal estuaries are reviewed. The major influence of the ebb currents, is based on the characteristics of tidal channel morphology and on the coincidence of stronger velocities with low water levels. The hydrodynamic phenomena in the outside channels and the influence of the characteristics of the sediments and of the ocean currents, on the shape, depth and stability of the outside channels are discussed. Special attention is given to the difference in behavior of the outside channels when the outside bars are fed with bed-load (sand) or suspended-load (silt or clay). (Knapp-USGS)
W71-01795

HYDROGRAPHIC CHANGES IN THE EDINBURGH CHANNELS, OUTER THAMES ESTUARY, U.K.,
Bedford Coll., London (England).
I. P. Jolliffe.
In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 257-274, 1969. 18 p, 13 fig, 6 ref.

Descriptors: *Estuaries, *Silting, *Sedimentation, *Mapping, Currents (Water), Tides, Tidal effects, Bed load, Channel morphology, Navigation, Scour, Erosion, Deposition (Sediments).
Identifiers: Thames Estuary (England).

A detailed chart analysis shows morphological changes in the outer Thames estuary by means of various cartographic techniques. The whole of the estuary bed is undergoing changes, but the broad pattern of long banks and intervening deeps has remained more or less the same for a period of over 100 years. The banks change principally by longitudinal extension. More significantly, major, rapid and unpredictable changes occur in the transverse swatchways and on the sills between the ebb and flood channels. The ebb-flood channels, which tend to be mutually evasive, characterize much of the central and northern parts of the outer estuary and are developed on a smaller scale within the Edinburgh Channels system. (Knapp-USGS)
W71-01796

STUDY OF THE INFLUENCE OF A DAM, BUILT IN A TIDAL ESTUARY, ON ITS TIDAL CHARACTERISTICS,
Laboratorio Nacional de Engenharia Civil, Lisbon (Portugal).
For primary bibliographic entry see Field 08B.
W71-01797

MATHEMATICAL SIMULATION OF TWO-DIMENSIONAL HORIZONTAL CONVECTIVE-DISPERSION IN WELL-MIXED ESTUARIES,
Texas Univ., Austin. Dept. of Civil Engineering.
Frank D. Masch, and Nilakantan J. Shankar.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 293-301, 1969. 9 p, 5 fig, 2 ref.

Descriptors: *Estuaries, *Convection, *Dispersion, *Mixing, *Texas, *Mathematical models, Model studies, Computer models, Sediment transport, Currents (Water), Water circulation, Salinity, Saline water systems.
Identifiers: Well mixed estuaries, Galveston Bay.

A finite difference transport model was developed for solving the convective-dispersion equation in two-dimensional well-mixed estuaries. The transport model is structured in such a way that it accepts as basic input net velocities and depths from a two-dimensional hydrodynamic model. The model describes transport by convection and dispersion over long periods of time for constant hydrologic inputs. The adaptability of the finite difference model to real estuarine systems is demonstrated by its application to the Galveston Bay complex, an estuary typical of the bays along the Gulf Coast of the United States. The transport model was also used to evaluate the effect of enlarging an existing pass in the bay on the salinity of the system. (Knapp-USGS)
W71-01798

FLUME STUDY ON SALINITY INTRUSION IN ESTUARIES,
Waterloopkindig Laboratorium, Delft (Netherlands).
A. J. van Rees, and B. P. Rigter.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 303-310, 1969. 8 p, 3 fig.

Descriptors: *Estuaries, *Saline water intrusion, *Hydraulic models, *Mixing, Tides, Currents (Water), Salinity, Saline water systems, Turbulent flow, Turbulence, Mass transfer, Mathematical models, Model studies, Flumes, Laboratory tests, Hydraulic similitude, Reviews.
Identifiers: Netherlands, Delft, Delft Hydraulics Laboratory.

An outline is given of a current research program being carried out by the Delft Hydraulics Laboratory, on salinity intrusion in estuaries. The study uses a flume, which essentially is a schematized river of rectangular cross-section issuing into a basin equipped for the generation of tides and control of source salinity. One purpose of the study is to find optimum reproduction of prototype conditions in estuary models and to obtain an analytical description of the estuarine streampattern under varying conditions. In this connection the flume experiments are intended to reveal details about the turbulent exchange of momentum and mass, required for a numerical treatment of the problem. (Knapp-USGS)
W71-01799

DAMPED COOSCILLATING TIDE WITH NEGATIVE REFLECTION AT THE END OF THE ESTUARY,
Ecole Polytechnique, Montreal (Quebec).
Hans-Werner Partenscky, and Jean-Claude Warmoes.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 363-370, 1969. 8 p, 4 fig.

Descriptors: *Mathematical models, *Fourier analysis, *Tidal effects, *Tides, *Estuaries, St. Lawrence River, Water level fluctuations, Streamflow, Waves (Water), Surges, Fluid friction, Wavelengths, Numerical analysis.
Identifiers: Tidal velocities.

Harmonic analysis of damped cooscillating tides in an estuary was applied to cases where the incoming tidal wave undergoes a negative reflection at the upstream end of the estuary due to a sudden enlargement of the channel width. The basic equations for the tidal elevations, tidal discharges and velocities are derived for the general case of an estuary in which the surface width and mean water depth are functions of distance. Expressions are determined for the local time of high water at a given section relative to the head of the estuary, as well as for the variation in tidal wave length with distance. An overall damping coefficient is defined in which the effects of frictional energy dissipation and reflection of wave energy from the lateral boundaries are combined. The developed mathematical model was applied to the Estuary of the St. Lawrence River, Canada. The results were in good agreement with field measurements. (Knapp-USGS)
W71-01808

ON VERTICAL SALINITY DISPERSION INTO FRESH WATER OVER SALT WATER DUE TO TURBULENCE,
Kyoto Univ. (Japan). Dept. of Agricultural Engineering.
Isao Minami.
In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 381-387, 1969. 7 p, 3 fig, 4 ref.

Descriptors: *Mixing, *Turbulent flow, *Stratified flow, *Vorticies, *Eddies, Mass transfer, Dispersion, Diffusion, Density stratification, Saline water-freshwater interfaces.
Identifiers: Turbulon models.

Theoretical estimation of vertical salinity dispersion into fresh water from underlying salt water is treated from the standpoint of 'turbulon' of eddy dispersion. The characteristics of isotropic turbulence are found in turbulon motion in both fresh and salt water. In the vertical dispersion of salinity in stratified flow, the contribution of larger turbulons to vertical salinity dispersion is strongly depressed by the buoyancy effect; thus salinity dispersion is largely caused by the smaller turbulons. Analytical solutions for salinity distribution and dispersed salinity into fresh water layers from salt water are deduced from the results of application of the turbulon model as a conveyance of salinity. (Knapp-USGS)
W71-01810

MATHEMATICAL MODEL OF THE RECOVERY OF SALINITY STRATIFICATION IN THE UNSTEADY FLOW REGIME (FRENCH),
Electricite de France, Paris.
F. Boulot, and A. Daubert.
In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 353-362, 1969. 10 p, 3 fig, 1 tab, 6 ref.

Descriptors: *Saline water intrusion, *Estuaries, *Stratified flow, *Mathematical models, Density stratification, Unsteady flow, Streamflow, Numerical analysis, Model studies, Mixing, Salinity, Saline water systems, Saline water-freshwater interfaces.
Identifiers: Rhone Estuary (France).

A mathematical model was made of the intrusion of salinity in stratified layers (salt wedge). This model deals with unsteady flows of two fluids of slightly different densities with a free surface and an interface. The equations, assuming gradually varying flows, lead to a system of partial differential equations, which is solved numerically by the Lax-Weddroff explicit scheme. This computation program was used for the calculation of the slat wedge in the Grand Rhone, France. Comparisons of the results with in situ measurements show the position of the salt wedge and its movements under the effect of tide. Difficulties of calibration are mentioned and especially the impossibility of getting data for a stationary salt wedge. (Knapp-USGS)
W71-01812

SALINITY EFFECTS ON ESTUARINE HYDRAULICS AND SEDIMENTATION,
Army Engineer Waterways Experiment Station, Vicksburg, Miss. Hydraulics Div.
Henry B. Simmons, and Fred R. Brown.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 311-325, 1969. 15 p, 7 fig.

Descriptors: *Estuaries, *Saline water intrusion, *Mixing, Tidal effects, Current (Water), Water circulation, Sedimentation, Deltas, Mississippi River, Delaware river, Channel morphology, Discharge (Water), Tides, Streamflow, Sediment transport, Surveys, Reviews, Saline water-freshwater interfaces, Stratified flow, Density stratification.
Identifiers: Vicksburg (Miss.), U. S. Army Corps of Engineers, Waterways Experiment Station, Savannah River.

Waters of variable density in tidal estuaries result in marked differences in the magnitude, distribution, and duration of currents which in turn affect the shoaling characteristics. For purposes of this paper the degree of mixing has been separated into three broad categories of highly stratified, partly mixed, and well mixed. The most important characteristics of each category are illustrated by observations made in some of the larger estuaries of the United States, such as the Mississippi River, Savannah Harbor, and the Delaware River. Changes in the upland discharge, tidal prism, and physical configurations of estuaries will alter the degree of salt- and fresh-water mixing and affect the direction and degree of flow predominance and the location and amount of shoaling. The effect of changes in the upland discharge is of primary importance. (Knapp-USGS)
W71-01813

A CONDUCTIVITY BRIDGE FOR THE MEASUREMENT OF SALINITY OF SEA WATER,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 07B.
W71-01877

BIOENVIRONMENTAL AND RADIOLOGICAL SAFETY FEASIBILITY STUDIES ATLANTIC-PACIFIC INTEROCEANIC CANAL. FINAL REPORT, TERRESTRIAL ECOLOGY,
Georgia Univ., Athens. Inst. of Ecology.
For primary bibliographic entry see Field 05C.
W71-01883

BIOENVIRONMENTAL AND RADIOLOGICAL-SAFETY FEASIBILITY STUDIES: ATLANTIC-PACIFIC INTEROCEANIC CANAL. DARIEN FISH DIETARY,
Battelle Memorial Inst., Columbus, Ohio.
For primary bibliographic entry see Field 05C.
W71-01884

RESEARCH ON THE MARINE FOOD CHAIN. PROGRESS REPORT, JULY 1968-JUNE 1969, VOLUME 1. CHEMISTRY AND MICROBIOLOGY,
California Univ., San Diego, La Jolla. Inst. of Marine Resources.
For primary bibliographic entry see Field 05A.
W71-01885

CRITERIA FOR RECOGNITION OF ESTUARINE WATER POLLUTION BY AERIAL REMOTE SENSING,
Rhode Island Univ., Kingston. Dept. of Geology.
For primary bibliographic entry see Field 05B.
W71-01900

WATER RESOURCES INVENTORY OF CONNECTICUT - PART 4. SOUTHWESTERN COASTAL RIVER BASINS,
Geological Survey, Hartford, Conn.
For primary bibliographic entry see Field 02E.
W71-01912

TIDAL RELATIONS ALONG THE INTRACOASTAL WATERWAY, BROWARD COUNTY, FLORIDA,
Geological Survey, Tallahassee, Fla.
James J. Schneider.
Geological Survey Open-file Report 70006, June 1970. 17 p, 6 fig, 1 tab, 3 ref.

Descriptors: *Tidal waters, *Inland waterways, *Florida, Tides, Flow profiles, Water levels, Tidal effects, Atlantic Ocean.
Identifiers: *Tidal range, *Broward County (Fla.).

One of the most intensely developed urban areas in the Nation borders the Intracoastal Waterway in Broward County, Florida. An investigation was made to assist County officials in establishing the elevation of mean high water and tidal patterns along the waterway. The results of the investigation are based on records collected from five tide gages during the period March 1, 1968 through February 28, 1969. Along the waterway, mean high water was approximately 1.5 feet above mean sea level. The mean tidal range in the waterway at Hollywood was 0.6 foot less than the tidal range of the ocean at Miami Beach. The difference between mean half tide and mean water level was negligible at all stations. The average time difference for high and low tides, referred to Miami Beach, ranged from zero at Port Everglades to plus one hour and 40 minutes at Hollywood. (Woodard-USGS)
W71-01913

THE ENCROACHMENT OF THE SALT WATER IN KOITO RIVER MOUTH RESERVOIR,
Chiba Prefecture Industrial Water Dept. (Japan); and Mitsui Consultants Co., Ltd., Tokyo (Japan).
Tatsuya Ikeda, and Yasuo Miyake.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 103-110, 1969. 8 p, 6 fig, 2 tab.

Descriptors: *Saline water intrusion, *Reservoirs, *Computer programs, *Groundwater movement, Canal seepage, Reservoir leakage, Land reclamation, Drainage, Leaching, Saline soils, Wetlands.
Identifiers: Japan, Koito River, Koito Reservoir.

A computer program is presented to calculate seepage of saline water from a reclaimed salt marsh into a freshwater reservoir. The calculation is illustrated by the example of the Koito River Reservoir, Japan, which was constructed in a coastal excavation from which reclamation dike materials were taken. (Knapp-USGS)
W71-01942

PUMPING FROM A SHALLOW WATER AQUIFER IN A COASTAL REGION,
Asian Inst. of Tech., Bangkok (Thailand). Dept. of Hydraulic Engineering.
Norbert L. Ackermann, and Hung Tao Shen.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 67-75, 1969. 9 p, 2 fig, 1 ref.

Descriptors: *Groundwater movement, *Saline water-freshwater interfaces, *Saline water intrusion, Aquifers, Beaches, Mixing, Withdrawal, Water levels, Mathematical studies.
Identifiers: Coastal aquifers, Upconing.

A two dimensional study was made of the flow conditions produced by the pumping of water from a fresh water aquifer which was bounded on its lower surface by a stationary fluid of higher density (salt water) and bounded on its upper surface by a horizontal plane having a constant piezometric head. The withdrawal of the fresh water was produced by continuous pumping from a series of line sinks or drains spaced at periodic intervals in the fresh water region. The pumping produced upconing of the interface in the vicinity of the line sink and general rising of the level of the freshwater-saltwater boundary when compared to conditions which would exist in the absence of pumping or at decreased pumping rates. The result of the mathematical analysis describing the flow conditions is presented graphically in dimensionless form. (Knapp-USGS)
W71-01944

THE ANALYSIS OF THE FLOW OF LAYERED FLUIDS,
New South Wales Univ., Kensington, (Australia). Dept. of Civil Engineering.
I. R. Wood.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2, (Subject B), Science Council of Japan, Kyoto, p 271-280, 1969. 10 p, 6 fig, 5 ref.

Descriptors: *Stratified flow, *Model studies, *Open channel flow, *Density stratification, Laboratory tests, Flumes, Interfaces, Mathematics, Equations, Flow rates, Temperature, Salinity, Diffusion, Estuaries, Oceans, Foreign projects.
Identifiers: *Australia.

It has long been recognized that fluids within estuaries are stratified and sometimes this stratification occurs in distinct layers. The internal flows produced by this stratification affect the diffusion of heat and salinity within estuaries and it is therefore important to understand the methods used in normal open channel flows to the calculation of flows in multilayer systems. In a two layer system two control points occur, one at the minimum width and one at a position away from the minimum width. The ratio of the discharges in the two layers is determined by calculations made at the control point away from the position of minimum width and the total discharge is determined by calculation at the minimum width. Experimental data are presented. (Woodard-USGS)
W71-01959

THE PRODUCTION OF ZOOPLANKTON IN SOUTHAMPTON WATER,
Southampton Univ. (England).
J. E. G. Raymont, and B. G. A. Carrie.
Int. Revue ges. Hydrobiological, Vol 49, No 2, p 185-232, 1964. 16 fig, 12 tab, 42 ref.

Descriptors: *Thermal pollution, *Thermal power plants, Plankton, Primary productivity, Temperature, Breeding, Zooplankton, Phosphates, Industrial wastes, Chlorophyll.
Identifiers: Southampton water, Seasonal fluctuation, Benthic species.

Quantitative zooplankton samples (500 litres) have been taken by the pump method, using No. 10 net at regular intervals from 1954 to 1959 at two thermal electric generating stations, Marchwood and Calshot in Southampton water. During the later years of the investigation warm water effluents have caused temperature around Marchwood to be somewhat higher. Marked seasonal changes in 300 plankton density are observed and are described in this report. The nauplii of cirripedes dominate the zooplankton numerically over much of the year. The zooplankton declines from about September, but there is a fair autumn density, especially at Marchwood, due mainly to copepods. Investigations during 1958 and 1959 showed that at Marchwood high phosphate concentrations (each 40 mg PO sub 4 as P/sub m 3) occurred over winter. Although a marked reduction accompanied the main burst of phytoplankton, relatively high phosphates were found over much of the year. At Calshot the phosphate values, though exceeding those for the English Channel are lower than at Marchwood. Plankton production in Southampton water is probably thus dependent to a considerable extent on nutrients derived from runoff and pollution. No reduction in zooplankton density appears to have followed the small rise in temperature which has occurred in Southampton water during investigation contains 42 references. (Upadhyaya-Vanderbilt)
W71-02070

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

SECOND REPORT ON DEVELOPMENT OF IMPROVED CELLULOSE ACETATE MEMBRANES FOR REVERSE OSMOSIS,
Hercules, Inc., Cumberland, Md. Allegany Ballistics Lab.
Mark E. Cohen, Michael A. Grable, and Billy M. Riggleman.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402. Price $0.75. Office of Saline Water Research and Development Progress Report No. 518, March 1970, 71 p, 16 fig, 20 tab, 8 ref. OSW Contract 14-01-0001-1647.

Descriptors: *Reverse Osmosis, *Membranes, *Desalination, Desalination processes, Semipermeable membranes.
Identifiers: *Hollow Fibers, *Asymmetric Membranes, *Composite Membranes, Cellulose Acetate, Cellulose Nitrate.

Improved hollow-fiber membranes were developed for reverse osmosis. Both asynmetric and composite membranes were investigated. These studies produced a new type of high flux asymmetric hollow-fiber membrane whose properties represent a significant advance in performance over current dense-walled, hollow-feiber membranes. Substantial progress was also made in the area of composite hollow-fiber membranes. The improved asymmetric hollow-fiber membranes, made of cellulose acetate, were prepared on a laboratory scale and performance tested singly and in bundles on brackish water feed. They deliver flux rates up to 2.3 gfd at 600 psi while rejecting 96.8% of the sodium chloride from a 5000 ppm solution. In contrast, dense-walled, hollow-fiber membranes exhibit flux rates of approximately 0.1 gfd under similar conditions. The new asymmetric hollow-fiber membranes withstand external pressures of at least 1,000 psi without collapse. Limited tests suggest that the flux decline rates of these membranes are similar to those of modified Loeb membranes. The feasibility of preparing asymmetric hollow-fiber membranes has been demonstrated. These membranes offer potential for further utilization in the development of economical and compact reverse osmosis modules. Their properties have not yet been fully optimized. (Horowitz-OSW)
W71-01746

MEMBRANES FOR REVERSE OSMOSIS BY DIRECT CASTING ON POROUS SUPPORTS,
Montana State Univ., Bozeman.
Robert L. Nickelson, E. A. Birkhimer, Darrel E. Coverdell, Juin-Yih Lai, and Donald G. J. Wang.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402. Price $1.00. Office of Saline Water Research and Development Progress Report No. 520, March 1970, 91 pa, 25 fig, 25 tab, 13 ref. OSW Grant No. 14-01-0001-672.

Descriptors: *Reverse Osmosis, *Membranes, *Desalination, *Porous Media, Desalination processes, Semipermeable membranes.
Identifiers: *Composite Reverse Osmosis Membranes, *Coated Porous Supports, Cellulose Acetate.

Cellulose acetate membranes cast under a variety of conditions on various support materials were tested with a standard 1% sodium chloride at different pressures. The objective was to examine the possibility of casting thin cellulose acetate membranes on the surface of porous materials that could serve to give mechanical strength to the membranes. Membranes cast from dilute cellulose acetate-acetone solutions onto a variety of commercially available filter materials were of poor quality. Attempts to cast ultra-thin layers of cellulose acetate on the supports always resulted in imperfect membranes. None of the support materials that were compatible with the casting solutions had enough mechanical strength to be advantageous. Membranes were then cast on flat porous supports using a ternary casting solution of cellulose acetate-formamide-acetone. Some of the best membranes gave reproducible results as follows: E400-25 cellulose acetate cast on epoxy filled fiberglass filter material (Versapor 6429) gave a product water flux of 21 GSFD with 95% salt rejection at 800 psi test pressure; E398-10 cellulose acetate cast on 2 micron pore size poly-vinyl chloride filter (Millipore) gave 21 GSFD with 97.3% salt rejection. The optimal casting solution for one support is not optimal for another so care must be taken in evaluating the performance of supports. (Horowitz-OSW)
W71-01747

A TRACER STUDY OF PRESCALING DEPOSITION OF SCALE FORMING COMPOUNDS ON CONTROLLED SURFACES,
North American Rockwell Corp., Canoga Park, Calif. Atomics International Div.
For primary bibliographic entry see Field 08G.
W71-01748

'INVESTIGATION OF MULTISTAGE FLASH PHENOMEAN IN A THREE-STAGE TEST SYSTEM',
American Machine and Foundry Co., Waterford, Conn. Cuno Div.
Fred Gilbert, and W. R. Williamson.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402. Price $2.75. Office of Saline Water Research and Development Progress Report No. 525, January 1970, 117 p, 15 tab, 30 fig, 2 ref. OSW Contract No. 14-01-0001-1253.

Descriptors: *Desalination, *Distillation, *Flash distillation, Testing, Desalination processes, Desalination plants.
Identifiers: M*Millstone Point Laboratory.

Multistage flash phenomena was investigated on a ten-stage flash module and a prototype flash test chamber. The investigation included determination of design parameters involving stage efficiency, heat transfer, mass transfer of liquid and vapors and effects of gas contamination. A two-stage flash test unit was rebuilt as a three-stage test device with the middle stage the test stage provided with fixed and movable thermocouple probes and velocity probes. The sides of the test stage were made of transparent sheet plastic to permit visual observation of the flash pattern both above and below the vapor-liquid interface. A test program was established to determine the empty stage non-equilibrium allowance for a range of test conditions, stage temperature, liquid level, flow rate and flashdown. Stage level measurements and interstage pressure drops and orifice areas were measured for all runs to determine interstage flow characteristics for a flashing stage. (Robinson-OSW)
W71-01749

EXPERIMENTAL DESALINATION TEST CELL AND MEANS FOR MEASURING THE CONCENTRATION POLARIZATION BOUNDARY LAYER IN A REVERSE OSMOSIS SYSTEM,
National Instrument Labs., Inc., Rockville, Md.
Herbert Goldsmith, and Houshang Lolachi.
For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC 20402. Price $0.55. Office of Saline Water Research and Development Progress Report No 527, May 1970. 41 p, 15 fig, 6 ref. OSW Contract 14-01-0001-1799.

Descriptors: *Reverse osmosis, *Membranes, *Boundary layers, Test procedures, *Desalination.
Identifiers: Membrane characterization test cell, Concentration polarization build-up, Membrane phenomenological coefficients, *Silver microprobes.

The main objective of this work was the study and measure of the concentration polarization directly in a desalination system. The geometry of this system must be such as to allow the mounting of measuring sensors without perturbing the polarization boundary layer. An annular geometry with a membrane placed on the outer surface of the inner tube with an access port placed in the outer tube permitted access to the concentration polarization boundary layer that is formed on the membrane surface. An exact analytical solution for the polarization profile in an annulus was quite complicated due to the non-linear nature of the defining equations, therefore as a first step some simplifying assumptions were made along the lines used by other authors in dealing with problems of this nature. These assumptions were: (1) The fluid is incompressible; (2) The flow is laminar; (3) The water flux is constant; and (4) Salt rejection by the membrane is complete. The solution to the above simplified system served as a starting point for the analysis of experimentally determinant salt concentration profiles. Deviations from this simplistic model may be significant and will undoubtedly lead to further refinement of the assumptions and the use of more elaborate numerical calculations. (Horowitz-Office of Saline Water)
W71-01752

ANNUAL REPORT (FY 1968) WEBSTER TEST FACILITY AND ELECTRODIALYSIS TEST-BED PLANT, WEBSTER, SOUTH DAKOTA.
Mason-Rust, Louisville, Ky.

For sale by Superintendent of Documents, US Goverment Printing Office, Wash, DC, 20402 - Price $1.50. Office of Saline Water Research and Development Progress Report No 567, June 1970. 128 p, 38 fig, 15 tab, 2 ref, 4 append. OSW Contract No 14-01-0001-1733.

Descriptors: *Desalination, *Pilot plants, *Electrodialysis, *South Dakota, Water costs, Economics, Facilities.
Identifiers: Webster (S Dak).

This Annual Report presents the Webster, S. Dak desalination Test Bed Plant Maintenance and Operational history, and the Experimental Program as carried out during the period 1 July 1967 through 30 June 1968. The Test Bed Plant consists of the four stage Asahi Chemical Industry (ACI) electrodialysis process for desalination of brackish water. Well water of 1500 ppm TDS, 48 deg F is pretreated by potassium permanganate addition followed by manganese Zeolite filtration for iron removal. Anion membrane fouling continued to be a major problem. The fouling is thought to be caused by a poisoning of the anion exchange membrane due to 'organics' with some contribution from iron, although the exact fouling agents have not been identified. Nightly acid backwashing was found to be successful towards control of iron deposits and the alkaline scale problems associated with anion membrane poisoning; however, the acid backwashing accounted for 56% of the plant downtime. Increased plant amortization and chemical demand costs associated with a lime softening and carbon filtration pretreatment system is expected to be more than offset by savings due to minimization of foulding problems, plus elimination of one electrodialysis stage, plus an increased product recovery from 50% to 70%. Various commericially available membranes were tested at temperatures between 48 deg F and 135 deg F using lime softened and carbon filtered Webster water. (Knapp-USGS)
W71-01754

1969-1970 SALINE WATER CONVERSION REPORT.
Office of Saline Water, Washington, D.C.

For sale by Superintendent of Documents, US Goverment Printing Office, Washington, DC 20402 - Price $0.75. Office of Saline Water Executive Summary Report, 1970. 28 p, 6 fig, 1 tab, 10 photo.

Descriptors: *Desalination, *Reviews, Research and development, Pilot plants, Desalination apparatus, Desalination processes, Economics, Water costs.

The research and development program progressed toward reducing the costs of fresh water from all desalting processes. The desalination program has moved from the laboratory into field testing of desalting plants with capacities up to 2.6 million gpd. Nearly 700 plants of 25,000 gpd capacity or larger are in operation or under construction throughout the world. These plants are capable of producing nearly 300 mgd. OSW is constructing a water desalting test vehicle to advance distillation systems through the development of components applicable to large production plants. Although no large seawater desalting plants have been built to date, OSW has been developing the necessary technology for their construction. Desalting plants of 1 million gpd capacity are now producing fresh water from seawater for about $1 per 1000 gallons. Plants of 2.5 million gpd are producing 1000 gallons of fresh water for about 85 cents. Water from a recently completed 7.5 million gpd plant in Mexico is expected to cost about 65 cents per 1000 gallons. Both distillation and membrane technology enjoyed a rewarding year. The ultimate disposal of brine either as a concentrated solution or as dry salts is also being investigated. (Knapp-USGS)
W71-01755

DESALINATION USING WASTE HEAT FROM THERMAL POWER STATIONS,
Baldwin-Lima-Hamilton Corp., Philadelphia, Pa.
R. A. Tidball, and J. G. Gaydos.
French and German abstracts. 3rd International Symposium on Fresh Water from the Sea, held at Dubrovnik, Yugoslavia, September 13, 1970, Vol 1, p 2070217, 1970. 11 p, 5 fig, 2 tab, 4 ref.

Descriptors: *Distillation, *Flash distillation, *Thermal powerplants, Desalination processes, Thermal pollution, Desalination plants, Water costs, Economics.
Identifiers: Waste heat utilization.

The use of very large steam turbines in the United States has been accompanied by a trend toward designing for higher back pressures. These higher back pressures in the condenser allow economic production of desalted water by flashing the condenser outlet water through one or more stages of flash distillation. Design of the systems and the economics of the water produced are discussed. This analysis is based on a narrow range of conditions. Additional work is required to determine limiting conditions of sea water temperature, power demand and water needs, amortization rates, and operating characteristics. (Lang-USGS)
W71-01778

SALINE GROUND-WATER RESOURCES OF THE TULAROSA BASIN, NEW MEXICO,
Geological Survey, Albuquerque, N. Mex.
For primary bibliographic entry see Field 03C.
W71-01870

NUCLEAR DESALINATION PROGRAM ANNUAL PROGRESS REPORT ON ACTIVITIES SPONSORED BY THE ATOMIC ENERGY COMMISSION FOR PERIOD ENDING OCTOBER 31, 1969,
Oak Ridge National Lab., Tenn.
T. D. Anderson, and W. E. Thompson.
Available from NTIS as ORNL-4538, $3.00 in paper copy, $0.95 in microfiche. ORNL-4538, May 1970. 52 p. Contract W-7405-eng-26.
Identifiers: *Desalination, *Nuclear power plants, *Irrigation systems, Desalination, Refining (Metallurgy), Costs.

Information is presented under the following headings: desalting plant system coupling studies; dual-purpose plant control studies; tradeoffs between electric power generation and transmission for large nuclear desalting plants; uncladmetal-fueled breeder reactor for desalting or power; metal-fueled pressurized-water reactors; general studies on agro-industrial complexes and of agricultural and industrial processes; applications of agro-industrial complexes; and Nuclear Desalination Information Center.
W71-01882

3B. Water Yield Improvement

LARGE SCALE DYNAMIC EFFECTS OF CLOUD SEEDING,
Aerometric Research, Inc., Goleta, Calif.
Keith J. Brown, and Robert D. Elliott.
Available from NTIS as PB-189 658, $3.00 in paper copy, $0.95 in microfiche. Final Report to Bureau of Reclamation, December 1969. 124 p, 3 tab, 32 fig, 12 ref. Contract 14-06-D-5963.
Identifiers: *Artificial precipitation, Statistical analysis, Atmospheric precipitation, Weather stations, Hygrometers, Storms, Nucleation, Ice, Cirrus clouds, Cumulus clouds, Wind, Convection (Atmospheric), Networks, Meteorological radar, Radar tracking, Cloud seeding, Winter.

The report covers a three and one half year study of the Large Scale Effects of Cloud Seeding. Included in this program was a statistical analysis of four long term operational cloud seeding projects and two randomized research type projects and finally a pilot field program to test the hypotheses developed in the statistical phase of the contract. The statistical analysis of past operational and research seeding projects showed considerable evidence that areas 70 to 150 miles downwind from the nuclei source were receiving increased precipitation during cloud seeding operations. In many cases the increases in the downwind area was equal or greater than those in the intended target areas. A field program conducted during the 1968-69 winter season essentially confirmed this finding. The field program consisted of a detailed analysis of raingage records from a dense gage network in and downwind from a randomized research program in Santa Barbara County, California. The observation and seeding unit employed on the combined project was a convective band embedded in a general storm system. The seeding was accomplished with a single ground source using a high output pyrotechnic device.
W71-01672

NATURAL RESOURCES IN THE COMMONWEALTH OF VIRGINIA,
Rural Affairs Study Commission, Richmond, Va.
S. Mason Carbaugh.
Available from NTIS as PB-189 752, $3.00 in paper copy, $0.95 in microfiche. October 20, 1969. 67 p.
Identifiers: *Economics, Virginia, *Natural resources, *Virginia, Soils, Water supplies, Air, Reviews, Rural areas, Population, Floods, Law, Terrain, Sanitary engineering, Land use, Zoning.

The report is essentially concerned with Virginia's soil, water, and air resources. Forestry, often considered a natural resource, is becoming increasingly thought of as a crop and is included under another study category. The State's mineral resources are also expected to be covered under the section on mining. Air as one of the more valuable natural resources is included herein as recognition of its importance in developing the rural areas of the State, and to emphasize the need for adequately considering it in future development plans. (See also W71-01879)
W71-01878

SUMMARY OF NATURAL RESOURCES IN THE COMMONWEALTH OF VIRGINIA.
Rural Affairs Study Commission, Richmond, Va.

Available from NTIS as PB-189 753, $3.00 in paper copy, $0.95 in microfiche. 1969. 9 p.
Identifiers: *Natural resources, *Virginia, *Rural areas, *Reviews, Soils, Water supplies, Air population, Predictions.

The report is essentially concerned with Virginia's soil, water and air resources. The development of these resources must be considered as a major factor in equipping Virginia's rural areas to absorb a larger share of the growing population. 1.5 million more people by 1980 and about 4.0 million more in 2000 than today will place greater demands and stresses on the soil, water, and air resources. (See also W71-01878)
W71-01879

3C. Use of Water of Impaired Quality

SALINE GROUND-WATER RESOURCES OF THE TULAROSA BASIN, NEW MEXICO,
Geological Survey, Albuquerque, N. Mex.
J. S. McLean.
For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price $2.75. Office of Saline Water R and D Progress Report No 561, June 1970. 128 p, 34 fig, 4 tab, 69 ref. OSW Agreement 14-01-0001-2091.

Descriptors: *Tularosa Basin, *Saline ground water, *Saline water, Aquifers, *Desalination, Saline water interfaces, Groundwater movement, Transmissivity, Specific yield, Water consumption, Saline water systems, Geohydrologic units, Water table.

The report describes the location, extent, and quality of saline ground water in the Tularosa Basin. It defines the volume of water of different ranges in concentration and the ease with which saline water can be recovered for conversion to fresh water. The altitude of isosaline surfaces and

thickness of the saline water zones are shown on maps of the entire basin and of the following detailed areas within the basin: Alamogordo, Tularosa, Carrizozo, and the Western margin of the basin. The most widely developed aquifer in the basin is the alluvial fill of tertiary to Holocene age which exceeds 6,000 feet in thickness in the southern part of the basin. Well yields of as much as 1,400 gallons per minute have been measured. (Sachs-Office of Saline Water)
W71-01870

FILTRATION PROBLEMS OF IRRIGATING AND WASHING SALINIZED SOILS,
Akademiya Nauk SSSR, Novosibirsk.
For primary bibliographic entry see Field 02G.
W71-01945

IRRIGATION WITH RECLAIMED WASTEWATER,
Hirsch and Koptionak, San Diego, Calif.
For primary bibliographic entry see Field 05D.
W71-02103

3D. Conservation in Domestic and Municipal Use

PRICE, DEMAND, COST, AND REVENUE IN URBAN WATER UTILITIES.
Hittman Associates, Inc., Columbia, Md.
For primary bibliographic entry see Field 06D.
W71-01837

LONG ISLAND WATER RESOURCES.
New York State Office of Planning Coordination, Albany.
For primary bibliographic entry see Field 06D.
W71-01988

DEVELOPMENTS IN WATER SYSTEM NETWORK DESIGN,
All-India Inst. of Hygiene and Public Health, Calcutta.
V. Raman.
In: Proceedings, American Society of Civil Engineers, Journal of the Sanitary Engineering Division, Vol 96, No SA5, p 1249-1263, October 1970. 50 ref.

Descriptors: *Water distribution (Applied), *Network design, *Networks, Water supply, Systems analysis, Operations research, Optimization, Mathematical models.

The systematic design of a water distribution system network has so far been an exception rather than a routine matter due to the labor and time involved in the process. New methods that have come into vogue have relieved much of the time-consuming and tedious nature of the analysis. The developments in the hydraulic analysis from trial and error and Hardy Cross methods, to electric pipeline analyzer and digital computing methods, the evolution of methods for systems balance, and direct and optimum design of water distribution networks, are presented. The respective advantages and limitations of each method are brought forth. Studies of the various methods show that lacunae still exist in the systems analysis and optimal design of water system network. (Davis-Chicago)
W71-02113

3E. Conservation in Industry

STOCHASTIC IRRIGATION PLANNING MODELS,
Harvard Univ., Cambridge, Mass. Center for Population Studies.
For primary bibliographic entry see Field 06A.
W71-02096

WATER USE EFFICIENCY IN THE DAIRY PROCESSING AND THE MEAT PACKING INDUSTRIES IN NEBRASKA,
Nebraska Univ., Lincoln. Dept. of Agricultural Economics.
Dennis D. Hackbart.
MS Thesis, Dept. of Agricultural Economics, University of Nebraska, May 1967. 61 p, 9 ref, 11 tab, 3 fig. OWRR Project A-004-NEB (4).

Descriptors: *Water allocation (Policy), Industrial use (Water), Water costs, Water cooling.
Identifiers: *Nebraska, University of California, Texas A and M University.

By analyzing in detail the water use policies of the dairy processing and meat packing industries in Nebraska, the author attempted to determine the relationship between the amount of water used, quantity of product produced, profit accrued and employment created for each industry. In addition, the economic feasibility of water saving technologies such as recirculation of water and automated cleanup processes in the industries was determined. The author concluded that although neither industry considered water costs to be a major expense, they did adopt water saving technologies in order to reduce water ecquisition costs. He also found that the dairy processing industry created more employment for each acre foot of water used than did the meat packing industry. However, the dairy processing industry added only one-third the value to its product per acre foot of water used as did the meat packing industry. (Holmes-Rutgers)
W71-02110

3F. Conservation in Agriculture

SOIL ASSOCIATIONS AND LAND CLASSIFICATION FOR IRRIGATION, SAN JUAN COUNTY,
New Mexico Agricultural Experiment Station, University Park.
H. J. Maker, C. W. Keetch, and J. U. Anderson.
Supported in part by funds provided by U. S. Department of Interior, as authorized under The Water Resources Research Act of 1964, Public Law 88-379. Available from NTIS as PB-195 826, $3.00 in paper copy, $0.95 in microfiche. September 1969. 40 p, 8 tab, 2 fig, 10 ref. Research Report 161. OWRR Project B-014-NMEX (3).

Descriptors: *Planning, *Land appraisal, *Irrigable land, *Land classification, *Soil classification, Irrigation water, New Mexico, Arid lands, Soil surveys, Soil types, Soil properties, Mapping, Data collections, Climatic data, Soil engineering, Irrigated land, Land use, Water allocation (Policy).
Identifiers: *Soil associations, *Irrigated crop, San Juan County (New Mexico).

The San Juan County general soil map was used to estimate the amount of irrigable land in each soil area. Approximately 38 percent of the soils (1,341,500 acres) are suitable as cropland under irrigation. Irrigable land is widely distributed and frequently occurs in small tracts, which limits its use for irrigation. The 18 soil associations are rated according to federal Water Resources Council's criteria which consider texture, moisture retention, depth, salinity, sodic conditions, permeability, erosion, topography and drainage. The soils are also classified according to the AASHO and the Unified systems. Topography, climate, land use, soil characteristics, present land use and irrigation potential are examined. The soils are reviewed for irrigation and engineering uses to provide information for preliminary planning for forestry, range, urban, engineering, recreation, wildlife and irrigation development. Tables show climatic data, soil characteristics, land classification criteria, irrigation land classes for soils and engineering soils. Figures show soil and irrigable land distribution. (Popkin-Arizona)
W71-01653

LAND CLASSIFICATION FOR IRRIGATION, CURRY COUNTY,
New Mexico Agricultural Experiment Station, University Park.
H. E. Dregne, J. U. Anderson, and H. J. Maker.
Supported in part by funds provided by U. S. Department of the Interior as authorized under Water Resources Act of 1964, Public Law 88-379 and by federal funds from the Water Resources Council. Available from NTIS as PB-195 827, $3.00 in paper copy, $0.95 in microfiche. October 1969. 8 p, 4 tab, 3 fig, 3 ref. Research Report 162. OWRR Project B-014-NMEX (2).

Descriptors: *Planning, *Land appraisal, *Irrigable land, *Land classification, *Soil classification, Irrigation water, New Mexico, Arid lands, Soil surveys, Soil properties, Mapping, Water allocation (Policy), Data collections, Soil types, Irrigated land.
Identifiers: *Soil association, *Irrigated crop, Curry County (New Mexico).

New Mexico is severely deficient in irrigation water supplies for expansion. Limited (expensive) water should be used on the most productive soils. This report which updates a 1968 publication shows the distribution and acreage of irrigable land in Curry County in easter New Mexico. Based on soil qualities, approximately 94 percent (or 840,000 acres) of the county, or five times the acreage of presently irrigated land, is suitable for irrigation. Irrigable land is widely distributed in fairly extensive areas. Irrigation will be limited by water supplies and economic restrictions rather than by the availability of suitable soils. A detailed soil survey of Curry County was published by the Soil Conservation Service (1958). Irrigable acreage was determined by cutting out and weighing each delineated soil-mapping unit from the map sheets in the survey report. Soil-mapping units were rated according to five classes of irrigability, using federal Water Resources Council criteria of texture, moisture retention, depth, permeability, erosion, slope, surface smoothness and drainage. Tables show soil-classification criteria, irrigable and non-irrigable land percentages, acreage and extent of 48 soil types and percentage of land in various irrigation classes. Figures show distribution of irrigation land classes and percent of irrigable land by township. (Popkin-Arizona)
W71-01654

STUDIES ON THE INFLUENCE OF MIST IRRIGATION ON THE MICROENVIRONMENT, GROWTH, AND DEVELOPMENT OF THE POTATO (SOLANUM TUBEROSUM),
Minnesota Univ., Minneapolis.
For primary bibliographic entry see Field 02I.
W71-01656

SOIL - CROP - TILLAGE INTERACTIONS IN DRYLAND AND IRRIGATED FARMING,
Hebrew Univ., Jerusalem (Israel). Faculty of Agriculture.
Daniel Hillel, D. Ariel, S. Orlowski, E. Stibbe, and D. Wolf.
Available from NTIS as PB-190 438, $3.00 in paper copy, $0.95 in microfiche. Final Technical Report, US Dept of Agriculture, 1969. 300 p, 12 tab, 48 ref. A10-AE-3.
Identifiers: *Soils, Management planning, *Management planning, Irrigation systems, Site selection, Wheat, Grasses, Moisture, Rotation, Plants (Botany), Israel, Tillage, Dryland farming.

The project was an attempt to find answers to a number of fundamental and practical problems related to soil management in an arid zone. Though the practice of tillage constitutes a major, and at times the major, cost item in crop production, it has not yet been studied adequately from the combined viewpoints of the agronomist, soil physicist and engineer. A coordinated effort was directed towards an examination of alternative tillage programs and practices in the contexts of dryland and irrigated farming under the conditions typically prevailing in Israel.

W71-01680

SOIL MOISTURE CHARACTERISTICS OF INDIAN GRUMOSOLS AS RELATED TO WHEAT PRODUCTION UNDER UNIRRIGATED CONDITIONS,
Jawaharlal Nehru Agricultural Univ., Jabalpur (India).
Y. D. Tiwari, T. A. Singh, and P. M. Tamboli.
Annals of Arid Zone, Vol 9, No 1, p 26-30, March 1970. 2 fig, 5 tab, 4 ref.

Descriptors: *Crop production, *Clays, *Soil moisture, *Wheat, *Soil physical properties, Water conservation, Montmorillonite, Infiltration, Hydraulic conductivity, Soil profiles, Soil water movement, Soil structure, Surface drainage, Rainfall, Monsoons, Crop response, Soil-water-plant relationships, Data collections, Water storage, Retention, Drainage practices.
Identifiers: *India, *Grumosols, *Bunding.

Bunding is a common practice in Indian monsoon areas and involves the blockage of drainage channels around 'Kheri' clay (grumosol) fields. Water accrued from monsoons is stored until about a month before planting winter crops, thus bringing about weed destruction and greater soil water retention. For testing the actual effects of bunding, adjacent bunded and unbunded soils were compared over 3 years (1964-67) for moisture retention and depletion, soil physical properties and wheat yield. Being argillaceous and high in montmorillonitic minerals, the soils were quite adhesive, swelled when wet, cracked when dry and had poor infiltration rates and hydraulic conductivities. Bunded soils had higher moisture storage and higher wheat yields, particularly in unusually low rainfall years. (Casey-Arizona)
W71-01703

SUBSURFACE APPLICATION AND SHALLOW INCORPORATION OF HERBICIDES ON COTTON,
Southwestern Great Plains Research Center, Bushland, Tex.
For primary bibliographic entry see Field 02I.
W71-01704

ECOLOGICAL STUDIES ON THE GRASSLANDS OF JHANSI, U.P.,
Indian Grassland and Fodder Research Inst., Jhansi (India).
K. A. Shankarnarayan, and P. M. Dabadghao.
Annals of Arid Zone, Vol 9, No 1, p 54-63, March 1970. 1 tab, 9 ref.

Descriptors: *Grasslands, *Biological communities, *Ecology, *Soil-water-plant relationships, *Soil physical properties, Soil texture, Soil profiles, Soil moisture, Soil types, Topography, Succession, Grasses, Legumes, Weeds, Pasture management, Geology, On-site investigations, Climate, Productivity, Depth, Distribution.
Identifiers: *India, *Forest grasslands, *Floristic affinities, *Soil depth, Anthropogenic effects.

Indian grasslands are considered intermediate between a forest climate and a desert climate and are stable preclimax communities. Around Jhansi the area is composed of varied grassland communities. Three genetic soil types were distinguished on the basis of profile developmental characteristics. Variations in soil properties have probably been generated by topographical variations. The climate and geology of the area are described. Using line transects during the primary growth period, differing grass communities were identified on the basis of dominant species composition and analyzed for soil and topographical characters. Nine communities were identified and described. Apparently, soil moisture status as influenced by topography, soil depth and soil texture determines community distribution. Floristic affinities indicate the communities are intergrading due to the operation of progressive and retrogressive succession aided by anthropogenic factors. Procedures are outlined for elimination of less productive species and introduction of more desirable species. (Casey-Arizona)
W71-01707

THE INFLUENCE OF TILLAGE PRACTICES ON YIELDS AND WEED CONTROL IN SAFFLOWER,
Nebraska Univ., Lincoln. Dept. of Agronomy; and Lincoln Univ., Mitchell. Scotts Bluff Experiment Station.
For primary bibliographic entry see Field 02I.
W71-01711

CONTROL OF WILD CANE IN SOYBEANS,
Nebraska Univ., Lincoln. Dept. of Agronomy.
O. C. Burnside.
Nebraska Agricultural Experiment Station, Journal Series, Paper No 2084. Weed Science, Vol 16, No 1, January 1968, p 18-22. 4 tab, 2 fig, 7 ref.

Descriptors: *Weed control, *Soybeans, *Herbicides, *Crop response, *Plant growth regulators, Weeds, Crop production, Sorghum, Cultivation, Nebraska, Semiarid climates, Depth, Competition, Seeds, On-site investigations, Greenhouses.
Identifiers: *Crop management, *Wild cane, *Weed infestation, *Herbicide application, Sorghum production, Trifluralin, Vernolate.

Wild cane (Sorghum bicolor (L.) Moench) is a tall forage-type sorghum found in Nebraska and other semiarid lands. The seed either shatters or otherwise gets to the soil, remains viable, emerges in ensuing years and causes an encroachment on soybean production. Wild cane competes for soil moisture with other plants. Greenhouse and field studies showed that alpha, alpha, alpha-trifluro-2, 6-dinitro-N, N-dipropyl-p-toluidine (trifluralin) gave better control of wild cane when incorporated in the soil above rather than below the wild cane seed. Of four herbicides studied in the field experiments, trifluralin gave the best control of wild cane in soybeans followed by S-propyl dipropylthiocarbamate (vernolate). Herbicides were more effective than cultivation in controlling wild cane, but neither alone was adequate. A combination of cultivation plus herbicides markedly increased soybean yield on wild cane infested areas. These results show that an economical soybean crop can be produced on wild cane-infested land. Tables of greenhouse and field wild cane growth as affected by planting depth, and trifluralin application for 1964 to 1966, and photographs of wild cane control are presented. (Popkin-Arizona)
W71-01713

WESTERN WHORLED MILKWEED AND ITS CONTROL,
Agricultural Research Service, Lincoln, Nebr. Crops Research Div.
M. K. McCarty, and C. J. Scifres.
Nebraska Agricultural Experiment Station, Journal Series, Paper No 2031. Weed Science, Vol 16, No 1, January 1968, p 4-7. 3 tab, 1 fig, 4 ref.

Descriptors: *Weed control, *Brush control, *Poisonous plants, *Herbicides, *Plant growth regulators, 2-4-D, 2-4-5-T, Arid lands, Rates of application.
Identifiers: *Western whorled milkweed, *Herbicide efficiency, *Picloram, Dicamba, Silvex, Amitrole.

Western whorled milkweed (Asclepias subverticillata (Gray) Vail), a poisonous pasture weed, can spread from scattered clumps to an almost solid, uniform stand in a few years. It is highly toxic to cattle. The most effective herbicide was 4-amino-3,5,6-trichloropicolinic acid (picloram). Application of 2-methoxy-3,6-dichlorobenzoic acid (dicamba) gave only fair results. 2,4-dichlorophenoxyacetic acid (2,4-D),2,4-5-trichlorophenoxyacetic acid (2,4,5-), 2- (2,4,5-trichlorophenoxy) propionic acid (silvex), and 3-amino-1,2,4-triazole (amitrole) gave ineffective control. Addition of amitrole did not enhance effectiveness of dicamba or picloram. Tables of pretreatment and post-treatment specie density and a photograph of the species in bloom are included. (Popkin-Arizona)
W71-01715

LOSS OF HERBICIDES IN RUNOFF WATER,
Texas A and M Univ., College Station. Dept. of Soil and Crop Science.
For primary bibliographic entry see Field 05B.
W71-01716

ARTIFICIAL GROUNDWATER RECHARGE THROUGH BASINS IN THE TEXAS HIGH PLAINS,
Agriculture Research Service, Bushland, Tex.
For primary bibliographic entry see Field 04B.
W71-01719

PREDICTION OF ORIFICE DISCHARGE AND HEAD LOSS ALONG A SMALL DIAMETER TERMINAL PERFORATED PIPE,
New Mexico State Univ., University Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W71-01776

CONSUMPTIVE USE OF WATER BY SUGARCANE IN HAWAII,
Hawaii Univ., Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 02D.
W71-01902

RUMANIAN IRRIGATION.
For primary bibliographic entry see Field 08A.
W71-01905

ADVANCE OF IRRIGATION WATER ON THE SOIL SURFACE IN RELATION TO SOIL INFILTRATION RATE: A MATHEMATICAL AND LABORATORY MODEL STUDY,
Iowa State Univ., Ames. Dept. of Agronomy.
For primary bibliographic entry see Field 02G.
W71-01964

THE OUTLOOK FOR WASTE WATER UTILIZATION IN ISRAEL,
Technion - Israel Inst. of Tech., Haifa. Sanitary Engineering Labs.
For primary bibliographic entry see Field 05D.
W71-02104

THE ALLOCATION AND PRICING OF WATER IN A RIVER BASIN,
Guelph Univ. (Ontario); and University of New England, Armidale (Australia).
For primary bibliographic entry see Field 06C.
W71-02107

ALLOCATING A LIMITED SUPPLY OF WATER FOR IRRIGATION,
Nebraska Univ., Lincoln.
Carl B. Lewis.
PhD Thesis, University of Nebraska, June 1969. 135 p, 55 tab, 55 ref. OWRR Project A-004-NEB (5).

Descriptors: *Water allocation (Policy), Irrigation programs, Comparative benefits, Budgeting, Comparative costs.
Identifiers: *Linwood Unit, Nebraska, Platte River.

This thesis developed and tested procedures for planning the most economically beneficial allocation of limited surface water supplies for irrigation purposes. The author examined four alternative schemes for irrigating land along the Platte River in Butler and Saunders Counties in Nebraska. The four plans were to irrigate 10,500 or 21,000 acres

from a stored water supply, or from water diverted directly to the land from the river. After presenting a detailed comparison of costs for each scheme, he concluded that irrigating 21,000 acres with water diverted directly from the river would achieve the 'highest net social product.' In addition, the author determined that the most economic way of allocating water during periods of water shortage was to irrigate 'crops in order of the ranking of returns over variable costs'. This plan, he concluded, was more economic than watering all crops uniformly. (Holmes-Rutgers)
W71-02108

IRRIGATION WATER SUPPLY: EFFICIENCY AND COST ASPECTS,
Nebraska Univ., Lincoln. Dept. of Agricultural Economics.
Ronald D. Cacek.
MS Thesis, Dept. of Agricultural Economics, University of Nebraska, May 1970. 55 p, 23 tab, 1 fig, 14 ref. OWRR Project A-004-NEB (3).

Descriptors: *Irrigation efficiency, Cost comparisons, Water costs.
Identifiers: *Bureau of Reclamation, Nebraska, Farwell, Sargent and Ainsworth Irrigation Districts.

The comparative efficiencies of three irrigation projects in central Nebraska were tested. Measurements were made of the amounts of water delivered to the user in relation to the amount of water which entered the irrigation system and the cost of delivery. The author concluded that the concrete lined system was more efficient in relation to costs of irrigation than the other two. (Holmes-Rutgers)
W71-02109

TILLSON V CRANE BROOK CO (LIABILITY FOR THE NEGLIGENT LOWERING OF WATER LEVELS).
For primary bibliographic entry see Field 06E.
W71-02198

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

YOUNG V SCOTT (LIABILITY FOR OBSTRUCTION OF FLOW OF SURFACE WATER FROM DOMINANT ESTATE).
For primary bibliographic entry see Field 06E.
W71-01655

USE OF NEW ANALYTICAL METHODS FOR WATER RESOURCE DEVELOPMENT,
Texas Univ., Austin. Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 06A.
W71-01658

MILLER V ZAHN (DOMINANT ESTATE'S LIABILITY FOR COLLECTION AND DISCHARGE OF SURFACE RUNOFF).
For primary bibliographic entry see Field 06E.
W71-01661

GEISERT V CHICAGO R I AND P RY (SERVIENT LANDS MUST SUFFER CONSEQUENCES OF UNRESTRAINED FLOW OF DRAINAGE FROM DOMINANT ESTATES).
For primary bibliographic entry see Field 06E.
W71-01674

EHLER V STIER (NULLIFICATION OF EASEMENT FOR DRAINAGE OF SURFACE WATER).
For primary bibliographic entry see Field 06E.
W71-01682

LYON V WATER COMM'RS OF CITY OF BINGHAMTON (RIGHT OF RIPARIAN OWNER TO FULL FLOW OF STREAM).
For primary bibliographic entry see Field 06E.
W71-01692

HAMMOND V ANTWERP LIGHT AND POWER CO (LIMITATIONS ON PRESCRIPTIVE RIGHT TO DIVERT STREAM FLOW).
For primary bibliographic entry see Field 06E.
W71-01693

FLOOD PLAIN INFORMATION, TUSCARAWAS RIVER, STARK COUNTY, OHIO.
Corps of Engineers, Huntington, W. Va.

Prepared for State of Ohio, Dept of Natural Resources. Corps of Engineers Flood Plain Report, January 1970. 45 p, 9 fig, 14 plate, 10 tab.

Descriptors: *Floods, *Flood damage, *Ohio, Flood plains, Regional flood, Flood forecasting, Flood control, Historic flood.
Identifiers: *Stark County (Ohio), Standard project flood, Intermediate regional flood.

Flooding along the Tuscarawas River within Stark County, Ohio is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and test material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. The greatest flood known for the past 100 years occurred in March 1913 and remained at flood stage for some 140 hours. Standard project flood determinations indicate that the upper limit of flooding would be about 5 feet higher than the 1913 flood. (Woodard-USGS)
W71-01773

FLOOD PLAIN INFORMATION, EAST FORK STONES RIVER, WOODBURY, TENNESSEE.
Corps of Engineers, Nashville, Tenn.

Prepared for town of Woodbury, Tenn. Corps of Engineers Flood Plain Report, August 1970. 35 p, 8 fig, 9 plate, 7 tab.

Descriptors: *Floods, *Flood damage, *Tennessee, Flood plains, Regional flood, Flood forecasting, Flood control, Historic flood.
Identifiers: *Woodbury (Tenn) area, Standard project flood, Intermediate flood.

Flooding along East Fork Stones River in the vicinity of Woodbury, Tennessee is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and test material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. The greatest flood known at Woodbury since 1902 occurred March 11, 1963 and crested at a stage of 16.52 feet (elev. 692.8) at the USGS gage. Other large floods occurred in Jan 1937, Feb 1948, June 1952, and March 1955. Main flood season is winter and early spring, but flooding from intense local storms can occur nearly all times of the year. Water velocities during major floods range up to 8 feet per second in the channel of East Fork Stones River. (Woodard-USGS)
W71-01774

WASHINGTON WATER CO V PARRETT (DAMAGES FROM DAM OVERFLOW).
For primary bibliographic entry see Field 06E.
W71-01811

BIRCH V BOSTON AND M RR (LIABILITY FOR FLOOD DAMAGE CAUSED BY OVERFLOW OF DRAINAGE DITCH).
For primary bibliographic entry see Field 06E.
W71-01871

A METHODOLOGY FOR FLOOD PLAIN DEVELOPMENT AND MANAGEMENT.
TRW Systems Group, Redondo Beach, Calif.
For primary bibliographic entry see Field 06F.
W71-01872

BELCASTRO V NORRIS (DRAINAGE RIGHTS ACROSS ADJOINING PROPERTY).
For primary bibliographic entry see Field 06E.
W71-01873

HOGAN V PENNSYLVANIA RR (ALLEGEDLY INADEQUATE CONDUIT NOT PROXIMATE CAUSE OF FLOODING).
For primary bibliographic entry see Field 06E.
W71-01874

PUBLIC POLICY AND SHORELINE LANDOWNER BEHAVIOR,
North Carolina Water Resources Research Inst., Raleigh.
For primary bibliographic entry see Field 06E.
W71-01888

NATURAL OIL SEEPAGE AT COAL OIL POINT, SANTA BARBARA, CALIFORNIA,
General Research Corp., Santa Barbara, Calif., and California Univ., Santa Barbara. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 05B.
W71-01904

FLOOD PLAIN INFORMATION-SOUTH FORK OF THE CROW RIVER, HUTCHINSON, MINNESOTA.
Corps of Engineers, St. Paul, Minn.

Corps of Engineers Flood Plain Report, April 1970. 43 p, 27 fig, 14 plate, 7 tab.

Descriptors: *Floods, *Flood damage, *Minnesota, Flood plains, Regional flood, Flood forecasting, Flood control, Historic flood.
Identifiers: *Flood recors, *Hutchinson (Minn.), Standard project flood, Intermediate regional flood.

Flooding along the South Fork of the Crow River within the city of Hutchinson, Minnesota is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and text material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. The greatest flood known to have occurred on the South Fork at Hutchinson occurred in April 1965 with an estimated peak discharge at Hutchinson of about 4,700 cubic feet per second. The total estimated damages including urban, residential, and business damage and Red Cross, National Guard, and emergency flood protection, were $320,000. Of the total damages sustained, the reach below the dam suffered damages estimated at $276,000, whereas damage above the dam was estimated to be $44,000 based on 1965 prices and conditions of development. (Woodard-USGS)
W71-01915

FLOOD PLAIN INFORMATION, BIG WILLIS CREEK, VICINITY OF GADSDEN, ALABAMA.
Corps of Engineers, Mobile, Ala.

Corps of Engineers Flood Plain Report, May 1970. 31 p, 3 fig, 23 plate, 10 tab.

Descriptors: *Floods, *Flood damage, *Alabama, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Gadsden (Ala), Standard project flood, Intermediate regional flood.

Flooding of Big Wills Creek, Gadsden, Alabama is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. The greatest flood known to have occurred on Big Wills Creek was the flood of December 29, 1942. There are no damage estimates available for this flood, although several homes along the stream were inundated. The April 1886 flood is the greatest recorded on the Coosa River at the Highway 431 bridge gaging station in Gadsden, 1.76 river miles upstream from the mouth of Big Wills Creek. (Knapp-USGS)
W71-01916

LINDENMUTH V SAFE HARBOR WATER POWER CORP (EASEMENT FOR FLOODING CAUSED BY DAM CONSTRUCTION).
For primary bibliographic entry see Field 06E.
W71-01924

RICHARDSON V TUMBRIDGE (NON-USE OF EASEMENT NOT TANTAMOUNT TO ABANDONMENT).
For primary bibliographic entry see Field 06E.
W71-01928

GENERAL CHARACTERIZATION OF DIFFERENT TYPES OF SEEPAGE,
Research Inst. for Water Resources Development, Budapest (Hungary).
Gyorgy Kovacs.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 205-214, 1969. 10 p, 1 fig, 10 ref.

Descriptors: *Groundwater movement, *Seepage, *Darcy's law, Hydraulic conductivity, Mathematical studies, Model studies, Velocity, Reynolds number, Viscosity.

Dynamic seepage through porous media can be divided into different types of movement according to the main active and passive forces by which the flow condition is influenced. A series of dimensionless numbers can be calculated to determine the general form of the equations of movement for each zone and to characterize numerically the limits of different types of seepage. The functions by which Darcy's hydraulic conductivity should be multiplied for characterization of the different types of seepage are listed. (Knapp-USGS)
W71-01935

A STUDY ON THE SEEPAGE FLOW OUT OF A FRESH WATER CANAL IN THE GROUND SATURATED WITH SEA WATER,
Kyushu Univ., Fukuoka (Japan). Dept. of Civil Engineering.
Masatsune Sakiyama, and Toshihiko Ueda.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 95-102, 1969. 8 p, 5 fig, 3 photo, 1 ref.

Descriptors: *Saline water-freshwater interfaces, *Seepage, *Groundwater movement, *Saline water intrusion, *Canal seepage, Path of pollutants, Mathematical studies, Model studies, Hydraulic models.
Identifiers: Coastal aquifers, Japan.

Fundamental model investigations were made on preventing seepage of salt water into sea-side reservoirs and salt nuisance near coasts. When a fresh water ditch is constructed in ground saturated with sea water, the fresh water pushes down the salt water and the seepage flow reaches a steady state. The fresh-salt interface, the seepage discharge, and the stream lines in the domain of the fresh water were studied by the theory of complex potential for two dimensional flow; and their results were ascertained by sand model tests. (Knapp-USGS)
W71-01943

FILTRATION PROBLEMS OF IRRIGATING AND WASHING SALINIZED SOILS,
Akademiya Nauk SSSR, Novosibirsk.
For primary bibliographic entry see Field 02G.
W71-01945

SOME DYNAMIC PROBLEMS OF THE MECHANICS,
For primary bibliographic entry see Field 08B.
W71-01946

RELATIONSHIP BETWEEN VELOCITY OF SEEPAGE AND HYDRAULIC GRADIENT IN THE ZONE OF HIGH VELOCITY,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 08B.
W71-01947

BURKE V BOSTON AND M RR (RAILROAD'S LIABILITY FOR DEATHS CAUSED BY ROADBED WASHOUT).
For primary bibliographic entry see Field 06E.
W71-01949

SEEPAGE LAW FOR MICROSEEPAGE,
Research Inst. for Water Resources Development, Budapest (Hungary).
Gyorgy Kovacs.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 1-7, 1969. 7 p, 2 fig, 9 ref.

Descriptors: *Seepage, *Groundwater movement, *Darcys law, *Hydraulic conductivity, Fluid friction, Hydraulic gradient, Soil water movement, Capillary conductivity, Diffusion, Laminar flow, Adhesion.
Identifiers: Poiseuille's equation, Non-Newtonian flow.

To calculate seepage which has a very small velocity, it is necessary that the non-Newtonian behavior of the fluid be taken into account. In this zone of seepage, where Darcy's law is not valid, gravity is balanced by friction and adhesion. The original Poiseuille's equation was modified to include the effect of adhesion. The mean velocity taking into consideration the effect of molecular forces (adhesion) is the same as the quotient of the velocity of micoroseepage and the velocity of seepage determined by multiplying the gradient with Darcy's hydraulic conductivity. Thus the correct equations of movement for both the zone of microseepage and the zone of laminar movement can be derived. (Knapp-USGS)
W71-01950

THE PREDICTION OF WITHDRAWAL LAYER THICKNESS IN DENSITY STRATIFIED RESERVOIRS,
Tennessee Valley Authority, Norris. Engineering Lab.
For primary bibliographic entry see Field 02H.
W71-01954

LOUISVILLE AND NASHVILLE RR V MIDDLETON (LIABILITY FOR DAMAGE FROM OVERFLOW OF DRAINAGE WATER CAUSED BY ROAD CONSTRUCTION).
For primary bibliographic entry see Field 06E.
W71-01958

CHICAGO, ST L AND N O RR V HICKS (RAILROAD'S LIABILITY FOR FLOOD DAMAGE CAUSED BY ERODED EMBANKMENT).
For primary bibliographic entry see Field 06E.
W71-01963

DE KALB COUNTY V TENN ELEC POWER CO (LIABILITY FOR FLOOD DAMAGE CAUSED BY DAM OVERFLOW DURING UNPRECEDENTED FLOOD).
For primary bibliographic entry see Field 06E.
W71-01965

DEASON V SOUTHERN RY (DAMAGES FOR OBSTRUCTION TO DRAINAGE).
For primary bibliographic entry see Field 06E.
W71-02012

BENNETT V CUPINS (LIABILITY FOR DIVERSION OF SURFACE WATER).
For primary bibliographic entry see Field 06E.
W71-02058

ANTON V STANKE (UPPER PROPRIETOR'S LIABILITY FOR DAMAGE CAUSED BY HIS DIVERSION OF DRAINAGE WATER).
For primary bibliographic entry see Field 06E.
W71-02065

HERMAN V DREW (LANDOWNER MAY NOT INTERFERE WITH HIGHWAY DRAINAGE SYSTEM WHICH FOLLOWS THE NATURAL COURSE OF LAND'S DRAINAGE).
For primary bibliographic entry see Field 06E.
W71-02072

SIMONSON V ALDEN TOWNSHIP (LIABILITY FOR DRAINAGE OF SURFACE WATER).
For primary bibliographic entry see Field 06E.
W71-02077

THOMPSON V BOARD OF SUPERVISORS (RELIEF FROM ADMINISTRATIVE RULINGS).
For primary bibliographic entry see Field 06E.
W71-02078

OPTIMUM DESIGN OF COMPLEX WATER RESOURCE PROJECTS,
Rand Water Board, Johannesburg (South Africa).
For primary bibliographic entry see Field 06A.
W71-02088

A TWO-STEP PROBABILISTIC MODEL OF STORAGE RESERVOIR WITH CORRELATED INPUTS,
Toronto Univ. (Ontario).
V. Klemes.
Water Resources Research, Vol 6, No 3, p 256-267, June 1970. 12 p, 8 fig, 10 ref.

Descriptors: *Probability, *Transition flow, *Markov processes, *Reservoir storage, *Reservoir operation, *Input-output analysis, Monthly, Flows, Annual, Model studies.

Identifiers: *Moran's storage model, *Lloyd's model, *Gould's concept of transition probabilities, Transition matrix.

Fragmentation of Moran's storage model and decomposition of its transition matrix into a release rule and an input component were used to simplify the problem formulation for reservoirs with complex operating rules and to derive the Lloyd model directly from that of Moran by introducing two successive transitions of one variable instead of a single bivariate transition. Combined with Gould's concept of transition probabilities, the suggested model was used to take into account the correlation between monthly flows simultaneously with that between annual flows. The process of reservoir input was also concerned as a first-order Markov chain. Complete descriptions and illustrations of the schemes were given. (Kriss-Cornell)
W71-02090

FARRAR V SHUSS (RIGHTS OF SERVIENT LANDOWNER TO PREVENT FLOW OF SURFACE WATER ONTO HIS PROPERTY).
For primary bibliographic entry see Field 06E.
W71-02124

WINCHESTER WATER WORKS CO V HOLLIDAY (WATER COMPANY'S LIABILITY FOR DAMAGES RESULTING FROM BUILDING OF A FLASHBOARD DAM).
For primary bibliographic entry see Field 06E.
W71-02131

BOARD OF TRUSTEES OF TOWN OF AUBURN V CHYLE (CITY NOT LIABLE FOR FLOODING CAUSED BY STREET DRAINAGE).
For primary bibliographic entry see Field 06E.
W71-02132

BABER V GRIGGS (LIABILITY FOR DIVERTING SURFACE WATER FROM ROADWAY ONTO ADJACENT LAND).
For primary bibliographic entry see Field 06E.
W71-02133

PLANNING STANDARDS FOR STORM DRAINAGE,
Kansas City Public Works, Mo.
Myron D. Calkins.
Proceedings, American Society of Civil Engineers, Journal of the Urban Planning and Development Division, Vol 96, No UP1, p 53-58, March 1970.

Descriptors: *Drainage, *Planning, *City planning, *Runoff, *Drainage engineering, *Standards, Urbanization, Drainage practices, Drainage program, Sewers.
Identifiers: *Regional planning, Public works, Comprehensive storm drainage networks.

Designers of comprehensive storm drainage networks must consider all storm water flow tributary to watershed areas. The presence of governmental boundary lines which do not coincide with these watersheds introduces complicating factors to such designs. Cooperation between engineers responsible for planning in these jurisdictions can produce a unified design result for entire drainage networks. The Kansas City metropolitan area achieves such cooperation by adopting unified design standards produced by local engineers. These standards include accepted criteria for all phases of storm drainage problem analysis and plan preparation. Results of the use of these criteria by agencies throughout the metropolitan area include uniform designs, stage construction of drainage networks, and a more comprehensive understanding by local officials of mutual problem solutions. (Davis-Chicago)
W71-02146

LAKE MICHIGAN DEVELOPMENT PROPOSAL.
Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05G.
W71-02156

LITTLE FALLS FIBRE CO V HENRY FORD AND SONS (LIABILITY OF LICENSEE FOR MAINTENANCE OF FLASHBOARDS ON FEDERAL DAM).
For primary bibliographic entry see Field 06E.
W71-02159

GULF STATES STEEL CO V LAW (LIABILITY FOR FLOOD DAMAGE BY DAM OWNER).
For primary bibliographic entry see Field 06E.
W71-02166

ILHENNY V BROUSSARD (DIVERSION OF WATERS FROM NAVIGABLE STREAMS).
For primary bibliographic entry see Field 06E.
W71-02170

VOLENTINE V HOUSEMAN (LIABILITY FOR OBSTRUCTING DRAINAGE DITCH).
For primary bibliographic entry see Field 06E.
W71-02172

SCRANTON-PASCAGOULA REALTY CO V CITY OF PASCAGOULA (ARTIFICIAL CHANNEL MAY BECOME WATERCOURSE BY PRESCRIPTION).
For primary bibliographic entry see Field 06E.
W71-02173

MARTIN V LOUISIANA PUB UTIL CO (RIGHTS OF PARTIES UNDER WATER CONTRACT).
For primary bibliographic entry see Field 06E.
W71-02174

HAASE V KINGSTON CO-OPERATIVE CREAMERY ASS'N (OWNERSHIP OF LAND UNDER ARTIFICIAL LAKE).
For primary bibliographic entry see Field 06E.
W71-02177

DELTA FISH AND FUR FARMS V PIERCE (STATUS OF WATERS PREVIOUSLY ADJUDGED NON-NAVIGABLE).
For primary bibliographic entry see Field 06E.
W71-02179

PFANNEBECKER V CHICAGO RI AND P RY (LIABILITY FOR DAMAGES RESULTING FROM TWO OR MORE CAUSES).
For primary bibliographic entry see Field 06E.
W71-02180

PIKE RAPIDS POWER CO V SCHWINTEK (SPECIFIC PERFORMANCE OF CONTRACT TO CONVEY FLOWAGE RIGHTS).
For primary bibliographic entry see Field 06E.
W71-02181

BEAVERTON POWER CO V WOLVERINE POWER CO (BREACH OF ORAL CONTRACT TO CONVEY FLOWAGE RIGHTS).
For primary bibliographic entry see Field 06E.
W71-02182

ANDERSON V OTTER TAIL POWER CO (LIABILITY FOR BREACH OF COVENANT TO PROVIDE POWER FROM DAM).
For primary bibliographic entry see Field 06E.
W71-02183

CITY OF BARABOO V RAILROAD COMM'N (JUDICIAL REVIEW OF ADMINISTRATIVE ORDER TO LOWER DAM HEIGHT).
For primary bibliographic entry see Field 06E.
W71-02184

MILLER V PERKINS (OBSTRUCTION OF SURFACE RUNOFF).
For primary bibliographic entry see Field 06E.
W71-02186

MELANDER V FREEBORN COUNTY (DAMAGES TO LAND AND CROPS AS A RESULT OF DAM CONSTRUCTION).
For primary bibliographic entry see Field 06E.
W71-02188

MATTER OF FORD (COMPENSATION FOR DEPRESSED LAND VALUES WHERE REDUCED WATER SUPPLY UPSET RIVER'S ECOLOGY).
For primary bibliographic entry see Field 06E.
W71-02190

THOMPSON V WATER RESOURCES COMM'N (JUDICIAL REVIEW OF DREDGING PERMIT).
For primary bibliographic entry see Field 06E.
W71-02191

HOLYOKE WATER POWER CO V WHITING AND CO (UNAUTHORIZED USE OF WATER SUPPLY).
For primary bibliographic entry see Field 06E.
W71-02193

BELKUS V CITY OF BROCKTON (LIABILITY FOR FLOOD DAMAGE FROM BLOCKED STREAM).
For primary bibliographic entry see Field 06E.
W71-02194

TILLSON V CRANE BROOK CO (LIABILITY FOR THE NEGLIGENT LOWERING OF WATER LEVELS).
For primary bibliographic entry see Field 06E.
W71-02198

YASKILL V THIBAULT (LIABILITY OF LOWER RIPARIAN OWNER FOR BLOCKING STREAM).
For primary bibliographic entry see Field 06E.
W71-02199

4B. Groundwater Management

ARTIFICIAL GROUNDWATER RECHARGE THROUGH BASINS IN THE TEXAS HIGH PLAINS,
Agriculture Research Service, Bushland, Tex.
Donald C. Signor, and Victor L. Hauser.
Texas A and M University, Texas Agricultural Experiment Station, Miscellaneous Publication 895, September 1968. 8 p, 2 tab, 8 fig, 17 ref.

Descriptors: *Water management (Applied), *Artificial recharge, *Groundwater recharge, *Pit recharge, *Water conservation, Infiltration, Water spreading, Playas, Permeability, Perched water, Evaporation, Economic feasibility, Texas, Arid lands, Water loss, Sands, Clays, Particle size, Soil profiles, Hydraulic conductivity, Water levels, Piezometers, Hydrogeology, Nuclear meters.
Identifiers: *Recharge basin construction, *Texas High Plains, *Groundwater depletion, Runoff use.

Groundwater supplies in the 22.4-million acre Texas High Plains are being depleted by irrigation pumping. Artificial groundwater recharge is a means of managing water collected in playas. A recharge basin 120 by 240 feet was excavated in a

Bushland playa by removing clay to expose a 3 to 4-foot-thick sand. About 89 percent of the clear well water placed in the recharge basin infiltrated. The final loss rate from the basin was 0.06 inch per hour. This low rate resulted from a perched water table. The data indicated that a low infiltration rate, sustained over a large area, could recharge most of the runoff collecting in a playa. Geophysical, geological, particle-size distribution, hydraulic conductivity (double-tube permeameter method), stage-area, stage-volume and sub-basin hydrologic data are considered. Tables of soil texture and hydraulic conductivity, and figures showing geologic profile, aerial view of the basin and instrumentation, geohydrologic section, water loss and water levels versus time, elevation head versus depth, and neutron meter moisture determinations are presented. (Popkin-Arizona)
W71-01719

HYDROGEOLOGIC DATA FOR THE LOWER THAMES AND SOUTHEASTERN COASTAL RIVER BASINS, CONNECTICUT,
Geological Survey, Hartford, Conn.
For primary bibliographic entry see Field 02F.
W71-01816

SEPARATION OF OIL AND WATER WITH GRAVITY SEPARATOR (FRENCH),
Laval Univ., Quebec; and Hydraulic Research Inst., Bratislava (Czechoslovakia).
For primary bibliographic entry see Field 05G.
W71-01930

REMOVAL OF SALINE WATER FROM AQUIFERS,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
For primary bibliographic entry see Field 05G.
W71-01932

QUANTITY OF WATER FLOWING INTO CIRCULAR INFILTRATION GALLERY,
Kyushu Univ., Fukuoka (Japan). Dept. of Hydraulic Civil Engineering.
For primary bibliographic entry see Field 02G.
W71-01933

STUDY OF GROUNDWATER MOUNDS UNDER SPREADING AREAS,
Indian Inst. of Tech. (Bombay).
J. T. Panikar, and A. L. Mathur.
In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 232-234, 1969. 3 p, 2 fig.

Descriptors: *Artificial recharge, *Water spreading, *Mathematical models, *Hydraulic models, Capillary action, Hydraulic similitude, Water levels, Water table, Groundwater movement, Sands, Infiltration.
Identifiers: Boussinesq equation.

Artificial recharge of groundwater basins through water spreading was studied by analytical and analog analyses of the mechanism of mound formation, spacing of drains to restrict water table rise, and use of strip recharging. The analytical approach essentially consists in solving the Boussinesq equation of unsteady state, for given boundary conditions. The general character of the mound was found to be the same by both theoretical and experimental methods. Sand models have a great drawback in that capillary rise introduces serious errors. Dissipating mounds cannot be studied on sand models. The viscous flow model is a powerful tool to investigate the problems of groundwater movement with a free surface. (Knapp-USGS)
W71-01936

PUMPING FROM A SHALLOW WATER AQUIFER IN A COASTAL REGION,
Asian Inst. of Tech., Bangkok (Thailand). Dept. of Hydraulic Engineering.
For primary bibliographic entry see Field 02L.
W71-01944

THE LINEAR AND NON-LINEAR REGIMES OF THE FILTRATION LAW AND THEIR CONSEQUENCES IN GEOHYDRAULIC PROBLEMS,
Hydraulic Research Inst., Prague (Czechoslovakia).
For primary bibliographic entry see Field 02F.
W71-01948

LONG ISLAND WATER RESOURCES.
New York State Office of Planning Coordination, Albany.
For primary bibliographic entry see Field 06D.
W71-01988

4C. Effects on Water of Man's Non-Water Activities

CONTINUED EVALUATION OF ROADSIDE DEVELOPMENT AND EROSION CONTROL EXPERIMENTS. PART I. CAUSES AND CONTROL OF SOIL EROSION ON OKLAHOMA HIGHWAYS. PART II. MAINTENANCE OF VEGETATIVE GROUND COVERS ON OKLAHOMA HIGHWAYS. PART III. WEED CONTROL AND ERADICATION ON OKLAHOMA HIGHWAYS,
Oklahoma Agricultural Experiment Station, Stillwater.
Wayne W. Huffine, and Lester W. Reed.
Available from NTIS as PB-189 907, $3.00 in paper copy, $0.95 in microfiche. n.d. Oklahoma HPR-1 (5). 73 p.
Identifiers: *Roads, *Erosion, *Soil mechanics, Roads, Plants (Botany), Grasses, Maintainability, Herbicides, Fertilizers, Effectiveness, Oklahoma, Weed control.

This report records the findings of a one-year extension of a study for which a final report in three parts was completed in 1968. The extension made it possible for the researchers to make additional observations and measurements of experimental plots established for the first study. Recommendations are listed to hasten more effective implementation of the study results. Basically, the data reported is used to reiterate and reemphasize the need to improve vegetation mangement practices for better erosion control, greater thrift and density of ground covers, and more effective control and eradication of weed species.
W71-01681

URBAN HYDROLOGY,
Bauer Engineering, Inc., Chicago, Ill.
W. J. Bauer.
In: The Progress of Hydrology, Vol 2 - Specialized Hydrologic Subjects, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 605-637, published by Univ of Illinois, 1969. 33 p, 3 fig, 3 tab.

Descriptors: *International Hydrological Decade, Conferences, *Urbanization, *Storm runoff, *Rainfall-runoff relationships, Research and development, Mathematical models, Flood routing, Cost-benefit analysis, Water resources development, Forecasting, Hydrology, Hydraulics, Flood control, Water quality control, Engineering, Planning, Projects, Research facilities, Water storage, Computers, Instrumentation.
Identifiers: *Water resources research, *Urban hydrology.

This paper presents viewpoints of a practicing consulting engineer concerning the following aspects of urban hydrology: the controlling economic factors; the need for improved analytical and design techniques; and the use of simplified methods pending the gathering of data required for the use of improved techniques. The northeastern Illinois metropolitan area is used as an example in illustrating each of these aspects. Storm runoff in urban areas takes up valuable space, and only the location of this space is subject to engineering control. Therefore it is the volume of runoff more than the rate of runoff which is important to evaluate for design purposes. Runoff from urban areas presents a quality control problem. Therefore it behooves the planner to move in the direction of large storage and small rates of flow, because of the high cost of treatment at high rates of flow for short periods of time. All methods of analysis of storm runoff and the associated flow in open channels involve the use of mathematical models. Every decision regarding storm drainage, even one to do nothing, involves an allocation of space for the temporary storage of storm water, and therefore involves an acceptance of the cost associated with that decision. (Knapp-USGS)
W71-01822

A SUMMARY OF THE HOPKINS STORM DRAINAGE RESEARCH PROJECT: ITS OBJECTIVES, ITS ACCOMPLISHMENTS, AND ITS RELATION TO FUTURE PROBLEMS IN URBAN HYDROLOGY,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
John C. Schaake, Jr.
In: The Progress of Hydrology, Vol 2 - Specialized Hydrologic Subjects, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 638-665, published by Univ of Illinois, 1969. 28 p, 8 fig, 12 ref.

Descriptors: *International Hydrological Decade, Conferences, *Urbanization, *Rainfall-runoff relationships, *Routing, Research and development, Rational formula, Cities, Engineering, Education, Gages, Water resources development, Forecasting, Hydrology, Hydraulics, Stream gages, Storm runoff, Planning, Projects, Research facilities, Laboratories, Model studies, Technology, Computers, Instrumentation.
Identifiers: *Water resources research, *Urban hydrology.

Since its initiation in 1949, the Hopkins Storm Drainage Research Project had the following primary objectives: Development of the principles of hydraulic behavior of storm water inlets and the practical application of these principles to storm water inlet design practice; development of instruments for measuring and recording rainfall and storm runoff and the systematic collection of rainfall-runoff data; and development of the relationship between rainfall and runoff and application to storm sewer design practice. During the period 1949 to 1967, 52 locations were gaged. Some of these involved only a rainfall measurement, but 40 locations involved both rainfall and runoff gages. Some of the gaged catchments were sewered, but 29 of them were inlet areas. A computer model of the rainfall-runoff process was developed to predict runoff more accurately than any other method; it is based on sound physical principles, and runoff data are not required for its application. (Knapp-USGS)
W71-01823

EROSION CONTROL ON HIGHWAY RIGHTS-OF-WAY IN ARKANSAS,
Arkansas Univ., Fayetteville. Dept. of Agronomy.
For primary bibliographic entry see Field 02J.
W71-02051

BASIC CONTEMPORARY URBAN PROBLEMS,
Illinois State Div. of Highways, Springfield.
For primary bibliographic entry see Field 06B.
W71-02144

BURKE V SOUTHERN BELL TEL AND TEL CO (LIABILITY OF UTILITY COMPANY FOR OBSTRUCTION OF RIVER).
For primary bibliographic entry see Field 06E.
W71-02161

UNITED STATES V NORFOLK-BERKLEY BRIDGE CORP (LIABILITY OF BRIDGE COMPANY FOR OBSTRUCTING NAVIGATION).
For primary bibliographic entry see Field 06E.
W71-02163

STATE EX REL LANDIS V ROSENTHAL (EXCLUSIVE FRANCHISE FOR BRIDGE OPERATION).
For primary bibliographic entry see Field 06E.
W71-02168

FLORIDA EAST COAST RY V ACHESON (LIABILITY FOR OBSTRUCTION TO NAVIGATION).
For primary bibliographic entry see Field 06E.
W71-02171

FLAMBEAU RIVER LUMBER CO V GETTLE (RIGHT OF LUMBER COMPANY TO HAVE RIVER NAVIGABLE FOR DRIVING LOGS).
For primary bibliographic entry see Field 06E.
W71-02178

4D. Watershed Protection

HEARINGS AND REPORT ON AMENDMENT TO THE WATERSHED AND FLOOD PREVENTION ACT BEFORE THE SUBCOMMITTEE ON CONSERVATION AND CREDIT, COMMITTEE ON AGRICULTURE, US HOUSE OF REPRESENTATIVES, 88TH CONG, 2ND SESSION.
For primary bibliographic entry see Field 06E.
W71-01751

AN EVALUATION OF STREAMFLOW TIMING FROM SMALL WATERSHED IN NORTHEASTERN UNITED STATES,
Pennsylvania State Univ., University Park. School of Forest Resources; and Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 02E.
W71-01917

CALIBRATION ANALYSIS OF THE THREE LEADING RIDGE EXPERIMENTAL WATERSHEDS,
Pennsylvania State Univ., University Park. Dept. of Forestry and Wildlife.
For primary bibliographic entry see Field 02E.
W71-01918

DESIGN OF A HYDROLOGIC CONDITION SURVEY USING FACTOR ANALYSIS.

Research Paper No 5, Tennessee Valley Authority, Division of Water Control Planning, Knoxville, Nov 1965. 25 p, 1 fig, 18 tab, 3 append, 15 ref.

Descriptors: *Design, *Streamflow, *Hydrologic data, *Resource development, *Land use, *Analytical techniques, Watersheds, Runoff.
Identifiers: *Factor analysis, Variables.

This paper described one step of a TVA project to develop relations between streamflow and land use that could be used in resource development plans. The step showed the development of a land-use survey form that will be used in future inventories. A technique used, termed Area-Stream Factor Correlation (ASFAC), was derived from the hypothesis that variations in streamflow response from watersheds can be explained only by a systematic description of the area. The fundamental step was relating analytically derived stream factors to measured factors such as soils, land use, slopes, erosion, and management which control the volume of runoff that occurs at the runoff source areas. The survey data was taken from the Bradshaw Creek-Elk River pilot study and soil samples were taken to determine the proportionate content of sand, silt and clay. In addition, the upper Bear Creek Watershed was surveyed in considerable detail on both open-land and forested plots. Forty-four different variables were ultimately defined and measured in the various forest surveys. Hydrologic condition survey information from seven different geographic areas was analyzed and a brief description of each area was given. Initial screening of the survey data was taken before initiating factor analysis. Factor loadings which are an expression of the contribution of each factor in explaining the variables were determined. Reasons for retaining or deleting each variable were explained. (Kriss-Cornell)
W71-02085

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

PLAQUING AND IMMUNOLOGICAL METHODS FOR DETECTION AND IDENTIFICATION OF ENTEROVIRUSES,
Arizona Univ., Tucson. Dept. of Microbiology and Medical Technology.
Peter P. Ludovici, Rosella Riggin, and Marion L. Moore.
Available from NTIS as PB-195 824, $3.00 in paper copy, $0.95 in microfiche. Research Project Technical Completion Report, Water Resources Research Center, October 1970. 41 p, 8 tab, 43 ref. OWRR Project A-015-ARIZ (1).

Descriptors: *Waste water treatment, *Bacteria, *Membrane processes, Pollutant identification, *Viruses, Microbiology, Entric bacteria.
Identifiers: *Enterovirus, Bacteria removal, Membrane filtration, Plaquing, Poliovirus, Coxsackle B2, Echovirus, Plastic Panel Micro Culture.

In preliminary studies primary human amnion (HAM) plaqued with echovirus 13 but not with the other prototypes. Follow up studies showed that different amnions varied in their ability to form plaques with echoviruses. In detailed studies using suspended agar and monolayer agar overlay procedures, neither primary nor secondary HAM cultures produced plaques with any of the viruses. Hep-2 plaqued poliovirus 1 but not echovirus 13 or Coxsackie B2. Wi38 plaqued poliovirus 1 and echovirus 13 but not Coxsackie B2. The monolayer agar overlay procedure was superior to the suspended cell agar method because fewer cells were required. When Wi38 was used to detect natural viruses, concentrates from sewage yielded no plaques in 5 samples whereas 4 of the 5 concentrates were virus-positive by CPE in fluid cultures. One of two virus-positive concentrates from secondary treated wastewater gave 2 plaques per flask with Wi38. A plastic panel culture neutralization test was compared with the test tube method for the identification of viruses isolated from waste water. Only one out of the eight viruses studied was different being identified as type 3 polio by the standard test and type 2 polio by the panel method. (Ludovici-Arizona)
W71-01651

SURVEY TO DETERMINE QUANTITIES AND PROPERTIES OF SEWAGE FROM NAVAL VESSELS,
Marine Engineering Laboratory, Annapolis, Md.
For primary bibliographic entry see Field 05B.
W71-01690

SEEPAGE OF FEEDYARD RUNOFF WATER IMPOUNDED IN PLAYAS,
Southwestern Great Plains Research Center, Bushland, Tex.
O. R. Lehman, B. A. Stewart, and A. C. Mathers.
Texas A and M University, Texas Agricultural Experiment Station, Miscellaneous Publication 944, February 1970. 7 p, 5 tab, 3 fig, 5 ref.

Descriptors: *Water pollution sources, *Water quality control, *Seepage, *Soil contamination, *Water pollution, Agricultural watersheds, Impounded waters, Lagoons, Playas, Water storage, Natural recharge, Nitrates, Chlorides, Texas, Arid lands, Data collections, Sampling, Soil texture, Waste water (Pollution), Fine-textured soils.
Identifiers: *Groundwater pollution, *Agricultural pollution, *Feedyard runoff, Solute-soil reactions, Runoff control, Texas High Plains.

The Southern High Plains is experiencing rapid growth in cattle feedyards. Feedyard runoff waters contain large amounts of undesirable wastes. Playas act as natural lagoons and are being used to impound most of the surface runoff from feedlot watersheds. Playas can be grouped according to predominate soil texture. The 250-acre study playa near Amarillo is representative of fine-textured playas. It drains 3,700 acres and contains 1,250-acre feet of water when full. Runoff from storms and the adjacent 30,000-cattle feedyard was impounded. Soil samples were later taken from it and from a nearby, feedyard-runoff free playa. Analyses were made for a nitrite, nitrate, ammonium, chloride and water content. The data suggest that little or no deep nitrate seepage will occur through the bottom of fine-texture playas that receive feedyarcd runoff, though high chloride accumulations may be found. Tables show chemical and moisture analyses with depth at different sites of the feedyard and non-feedyard playas. Figures include soil texture map, aerial view of the study feedyard and playa and cross section of relative elevations of soil sampling sites. (Popkin-Arizona)
W71-01705

GAUGING AND SAMPLING INDUSTRIAL WASTE WATER (OPEN CHANNEL),
Department of Water Resources, New York. Bureau of Water Pollution Control.
Larry A. Klein, and Albert Montague.
Journal, Water Pollution Control Federation, Vol 42, No 8, Part I, p 1468-1475, August 1970. 13 fig, 4 ref.

Descriptors: *Monitoring, *Industrial wastes, *Open channel flow, *Sampling, Weirs, Flumes, Costs, Sewers.
Identifiers: *Gauging, V-notch weirs, Sampling devices.

Techniques and experiences in the gauging and sampling of open-channel flow as developed and used in controlling industrial waste discharges in New York City are described. These procedures were developed as a result of the imposition of sewer surcharges which are based on the volume and concentration of industrial wastes. Two primary methods are used: internal and external plant installations. Inplant gauging and sampling are accomplished by combining sporadic flows at an outlet using an inflatable gas bag and a portable ejection system. Variations in induatrial waste discharge practices are discussed and sampling devices and methods for the various conditions are described. Out-of-plant gauging and sampling employs three basic devices: a V-notch weir or Lagoflume in conjunction with a continuous-lead measuring device and a propeller meter with a submersible flow tube for a conversion to full-pipe flow. Advantages and disadvantages of each are discussed. It is concluded that with excercise of proper judgement these devices and techniques should adequately measure and sample the great majority of industrial waste discharges encountered in any municipality. (Sorber-Texas)
W71-01757

TRITIUM HYDROLOGY OF THE TALLAHASSEE, FLORIDA AREA WITH ANALYSIS BY LIQUID SCINTILLATION COUNTING WITHOUT ISOTROPIC ENRICHMENT,
Florida State Univ., Tallahassee. Dept. of Geology.
For primary bibliographic entry see Field 02K.
W71-01777

POTOMAC RIVER WATER QUALITY, WASHINGTON, D.C. METROPOLITAN AREA.
Federal Water Pollution Control Administration, Cincinnati, Ohio. Div. of Technical Services.
For primary bibliographic entry see Field 05B.
W71-01817

DIVISION OF ISOTOPES DEVELOPMENT RESEARCH AND DEVELOPMENT PROJECTS: 1969.
Division of Isotopes Development (AEC), Washington, D.C.

Available from NTIS as TID-25372, $3.00 in paper copy, $0.95 in microfiche. Progress Report, Feb 1970. 166 p.
Identifiers: *Radioactive isotopes, Research, *Radioisotope heat sources, *Labeled substances, *Water pollution, *Air pollution, Labeled substances, *Irradiated foods, *Radioactivation analysis, *Concrete polymer composities, *Radiation polymerization, Oil slicks.

A 1969 summary of the objectives, progress, results, and future plans for each of the research and development projects of the AEC Division of Isotopes is presented. The projects are separated into the following categories: radioisotopes production and materials; thermal applications development; uses in environmental and ocean sciences; radiation analysis and control; process radiation; radiation preservation of foods; and information services related to radioisotopes uses.
W71-01881

RESEARCH ON THE MARINE FOOD CHAIN. PROGRESS REPORT, JULY 1968-JUNE 1969, VOLUME 1. CHEMISTRY AND MICROBIOLOGY,
California Univ., San Diego, La Jolla. Inst. of Marine Resources.
John D. H. Strickland.
Available from NTIS as UCSD-10-P-20-52, $3.00 in paper copy, $0.95 in microfiche. IMR Report No. 69-9, 1969. 265 p. Contract AT (11-1)-Gen-10.
Identifiers: *Sea water, Chemical analysis, *Microbiology, Sea water, Temperature, Light, Marine biology, *Food chains.

Chemical investigations included determination of stable carbon isotopes in dissolved organic matter of the sea; micro-determination of uronic acids and related compounds in the marine environment; influence of temperature and solar radiation on vitamin B12, thiamine, and biotin in seawater, 13C: 12C ratios in dissolved and particulate organic matter in the sea; ecology of plankton in relation to vitamins; and determination of ammonia in natural waters. Microbiological studies included nitrification by marine bacteria in low concentrations of substrate and oxygen; cultural characteristics of a pelagic marine ciliate; determination of microbial biomass in ocean profiles; observations on continuous culture of a planktonic phagotrophic protozoan; and observations on heterotrophic activity in the eastern tropical Pacific.
W71-01885

THE APPLICATION OF PHASE SELECTIVE ALTERNATING CURRENT POLAROGRAPHY TO THE ANALYSIS OF HEAVY METALS IN WATER,
Georgia Inst. of Tech., Atlanta.
Robert Lon Poole, Jr.
PhD Thesis, Georgia Institute of Technology, August 1970. 73 p, 1 tab, 5 fig, 22 ref. OWRR Project A-020-GA (2).

Descriptors: *Chemical analysis, *Polarographic analysis, *Heavy metals, Inorganic components, *Metals, Chemical wastes, Water pollution sources, Pollutant identification, Surfactants, *Water analysis, *Analytical techniques, Chromium, Cobalt, Copper, Iron, Manganese.
Identifiers: Antimony, Bismuth, Cadmium, Indium, Lead, Mercury, Nickel, Thallium, Tin, Vanadium, Zinc.

The application of phase selective ac polarography and square-wave polarography to the analysis of heavy metals in water was investigated. Although both techniques were found to be suitable for water analysis, the majority of the study deals with the ac polarographic method due to unforeseen difficulties encountered in the construction of the square-wave polarograph. However, square-wave polarography did prove to be more sensitive than ac polarography. The square-wave technique was found to be more suitable for the analysis of species that are irreversible polarographically. In studies involving the reversible cadmium reduction and the irreversible zinc reduction in 1 F potassium chloride, the zinc response was better, with respect to the cadmium response, using square-wave polarography than ac polarography. The theory of ac and conventional dc polarography is presented. In addition, advantages and disadvantages of ac and square-wave techniques as compared with conventional polarography are dealt with. It has been found that the sensitivity of the ac polarographic instrument is such that the following metal ions can be detected down to a lower limit of about 10 to the minus 6 formula weights per liter: Sb (III), Bi (III), Cd (II), Cu (II), In (III), Pb (II), Sn (II), Sn (IV), and Zn (II). In addition, Co (II), Ni (II), Mn (II), Tl (I), Fe (II), and Fe (III) can be analyzed down to a limit of approximately 10 to the minus 6 formula weights per liter. Rather unsatisfactory results were obtained for Cr (III) and V (V) which could only be detected down to about 10 to the minus 4 formula weights per liter and all attempts to work with Al (III) failed. The ac technique has proven to be very suitable for the analysis of multicomponent systems. A number of such systems is discussed; particular attention is paid to metals which are normally difficult to simultaneously determine polarographically. The presence of surfactants (surface-active substances) commonly interferes with the ac polarographic technique. The problems associated with various types of surfactants are presented. A standard procedure for the elimination of interferences caused by surfactants has been developed. The results obtained from the analysis of some natural and industrial samples are reported.
W71-01895

CRITERIA FOR RECOGNITION OF ESTUARINE WATER POLLUTION BY AERIAL REMOTE SENSING,
Rhode Island Univ., Kingston. Dept. of Geology.
For primary bibliographic entry see Field 05B.
W71-01900

COLORADO TROUT LAKE STUDIES,
Colorado Dept. of Natural Resources, Fort Collins.
For primary bibliographic entry see Field 02H.
W71-01989

RAPID ANALYTICAL METHODS FOR THE INVESTIGATION OF METALS AND INORGANIC RAW MATERIALS. XII. DETERMINATION OF TRACE AMOUNTS OF BERYLLIUM IN MINERAL WATERS AND MINERALS,
California Univ., Livermore. Lawrence Radiation Lab.
For primary bibliographic entry see Field 02K.
W71-01990

PHYSICAL PROPERTIES OF ANIMAL MANURES ASSOCIATED WITH HANDLING,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Engineering.
A. T. Sobel.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 27-32. 5 tab, 8 fig, 11 ref.

Descriptors: *Physical properties, Bulk density, *Farm wastes, Liquid wastes, Particle size, *Poultry, *Cattle.
Identifiers: Volatile solids, Fixed solids, *Flowability, Freezing point, *Production.

This paper is concerned with various physical properties of chicken and dairy cow manure that have a relationship to handling. The properties are considered mainly from the standpoint of both fresh and diluted manure. The information reported was obtained from analysis concerned with the physical properties of animal manures and represents a summary of those properties which are specifically related to handling. These properties are: (a) basic physical composition, (b) particle density and bulk density, (c) production, (d) particle size and distribution, (e) dilution, (f) settling rate, (g) suspended and dissolved solids, (h) flowability, and (i) freezing point. (See also W71-01992). (Christenbury-Iowa State)
W71-01998

AMMONIA AND AMINES: COMPONENTS OF SWINE-BUILDING ODOR,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
J. R. Miner, and T. E. Hazen.
Transactions of the ASAE, Vol 12, No 6, 1969. 3 p.

Descriptors: *Farm wastes, *Hogs, *Odors, *Ammonia, Atmosphere, Anerobic digestion, Proteins, Amino acids, Isolation, Chemical properties, Density, Physical properties, Absorption, Chromatography.
Identifiers: *Amines, *Odor thresholds, Concentration, Boiling points, Dissociation constants, Detection, Animal chambers.

This paper represents another step in defining the atmosphere within the swine confinement building. Ammonia and the closely related amines are known to be produced during the decomposition of both animal and vegetable proteins. Research work involving gases over decomposing manure indicate amines, ammonia and sulfur containing compounds are probably important constituents of the swine odor. The paper outlines the formation of ammonia and amines, and gives threshold odor levels for them in air. Physical and chemical properties of the different amines are given as well as methods of isolation and detection. Experimental data was taken from two animal chambers which provided substantial control over environmental conditions. The measured concentrations of ammonia were less than the threshold odor levels, indicating one of two explanations must be true: (a) Ammonia is not an important component of the hog house odor or (b) the odor producers are additive in effect and ammonia can be perceived at concentrations below its threshold when combined with other odorous compounds. Chromatographic analysis was used for detection of the different amines. (White-Iowa State)
W71-02041

ISOLATION OF SALMONELLAE FROM RENDERED BY-PRODUCTS AND POULTRY LITTER CULTURED IN ENRICHMENT MEDIA INCUBATED AT ELEVATED TEMPERATURES,
Massachusetts Univ., Amherst. Dept. of Veterinary and Animal Sciences.
C. F. Smyser, G. H. Snoeyenbos, and Barbara McKie.
Avian Diseases, Vol 14, No 2, 1970, p 248-254. 6 tab, 13 ref. US Public Health Service Grant UI 00159-05.

Descriptors: *Poultry, *Salmonella, *Incubation, Farm wastes, Isolation, Temperature, Hydrogen ion concentration, Indicators.

Identifiers: *Enrichment media, Poultry litter, Rendered bynproducts, Plating medium.

Three enrichment media incubated at 42 plus or minus 1C were compared for isolating Salmonellae from rendered animal and marine by-products, and two of the media were compared for poultry litter. Salmonellae were recovered from 317 of the 755 rendered samples and from 203 of the 235 litter samples examined. Selenite brilliant-green sulfapyridiae (SBG sulfa), dulcitol selenite sulfapyridine (DSES), and tetrathionate brilliant-green (TBG) were equally effective. Each enrichment incubated at the elevated temperature was significantly more effective than TBG incubated at 37C for isolating salmonellae from fish meal. Essentially no difference was noted between brilliant-green (BG) agar and brilliant-green sulfadiazine (BGS) agar as a plating medium. The pH of the enrichment media at the termination of incubation could not be used as an indicator of the presence or absence of salmonellae. (White-Iowa State)
W71-02045

ENGINEERING EVALUATION OF VIRUS HAZARD IN WATER.
American Society of Civil Engineers. Sanitary Engineering Div.

In: Proceedings, American Society of Civil Engineers, Journal of the Sanitary Engineering Division, Vol 96, No SA1, p 111-161, February 1970. 2 tab, 140 ref, 1 append.

Descriptors: *Viruses, *Water quality, *Diseases, Infection, Environmental sanitation, Sewage treatment, Water purification.
Identifiers: *Virus hazard.

The evaluation is presented in terms of 13 questions: what virus infections may be spread through water. How important is water in transmitting virus disease. Can the coliform index be applied to an evaluation of enteric viruses in water. What is the status of control of infectious hepatitis transmission by shellfish. What is the status of sampling and detection procedures for viruses. What risk is associated with use of sewage effluents for crop irrigation. Do birds or animals contribute health important viruses to water. Do enteric viruses multiply in water. How significant is the hazard resulting from recreational use of impounded sources of drinking water supply. How effective are water purification processes in removing viruses. The report concludes that while further study is desirable, existing technology and careful, vigilant plant operation can provide an acceptable level of protection for water users. (Davis-Chicago)
W71-02112

RESEARCH NEEDS ON THERMAL AND SEDIMENTARY POLLUTION IN TIDAL WATERS.
American Society of Civil Engineers, New York. Hydraulics Div.

Journal of the Hydraulics Division, ASCE, Vol 96, No HY7, Proc Paper 7426, p 1539-1548, July 1970. 7 ref.

Descriptors: *Hydraulics, *Sedimentation, *Temperature, *Tidewater, *Water pollution, Estuaries, Instrumentation.
Identifiers: Sediments, Research needs.

When recently requested to identify the most pressing research need in its field, the ASCE Tidal Hydraulics Committee quickly arrived at the consensus opinion that thermal and sedimentary pollution of tidal water bodies were the major problem in need of research in its respective field. Upon designation of this research need the Tidal Hydraulics Committee was directed to develop the topic further, identifying the nature of the problems and dividing the subject into several smaller specific investigations. Over a period of a year valuable ideas and suggestions have been obtained from all committee members. These have culminated in the following report. The report describes the nature of the sedimentary and thermal pollution problems in tidal water and includes a review of the literature and some related research. The report outlines general and specific research needs in both thermal and sedimentary pollution and includes a section on instrumentation. (Preckwinkle-Chicago)
W71-02149

5B. Sources of Pollution

BYRAM V LAWEIN (DISCHARGE OF SEWAGE WATER ONTO ANOTHER'S LAND).
For primary bibliographic entry see Field 06E.
W71-01667

SURVEY TO DETERMINE QUANTITIES AND PROPERTIES OF SEWAGE FROM NAVAL VESSELS,
Marine Engineering Laboratory, Annapolis, Md.
K. Jacobson, and M. J. Posner.
Available from NTIS as AD-455 401, $3.00 in paper copy, $0.95 in microfiche. MEL-346/64 Report, January 1965. 13 p, 4 tab, 1 ref.
Identifiers: *Harbors, *Sewage, *Ships, *Wastes (Sanitary engineering), Bacteria, Rivers, Naval vessels (Combatant), Concentration (Chemistry).

A shipboard survey to determine the quantities of human wastes produced per capita and the physical, biological, bacteriological and chemical properties was conducted to establish the degree of pollution of harbor waters by naval vessels and provide design criteria for a treatment system. The data show that between 10 and 20 GPD of sewage are produced per capita on ships following a normal workday routine. A maximum of twice this amount can be expected of the operation is on an around-the-clock basis. The sewage produced contains an average of 236 mg/l of suspended solids and an average biochemical oxygen demand (BOD) of 102 ppm. The gometric average coliform density index was found to be 4.8 x 10 to the 5th. Data are also presented for the concentration of settleable solids, total solids and volatile solids present. The pH of the sewage and the dissolved oxygen present and the concentration of nitrogen present in various forms were determined. The survey also showed that the water in the vicinity of a vessel from which sewage is being discharged is not polluted to any adverse degree in terms of the commonly used parameters. Virtually no suspended solids were found in the river water and the coliform density was within the range permitted at most bathing beaches in the United States.
W71-01690

VILLAGE OF ORRVILLE V GOCHNAUER (MEASURE OF DAMAGES FOR STREAM POLLUTION).
For primary bibliographic entry see Field 06E.
W71-01691

SEEPAGE OF FEEDYARD RUNOFF WATER IMPOUNDED IN PLAYAS,
Southwestern Great Plains Research Center, Bushland, Tex.
For primary bibliographic entry see Field 05A.
W71-01705

CONTROL OF WILD CANE IN SOYBEANS,
Nebraska Univ., Lincoln. Dept. of Agronomy.
For primary bibliographic entry see Field 03F.
W71-01713

WESTERN WHORLED MILKWEED AND ITS CONTROL,
Agricultural Research Service, Lincoln, Nebr. Crops Research Div.
For primary bibliographic entry see Field 03F.
W71-01715

LOSS OF HERBICIDES IN RUNOFF WATER,
Texas A and M Univ., College Station. Dept. of Soil and Crop Science.
D. W. Trichell, H. L. Morton, and M. G. Merkle.
Weed Science, Vol 16, No 4, October 1968, p 447-449. 2 tab, 5 ref.

Descriptors: *Herbicides, *Runoff, *Weed control, *Brush control, *Plant growth regulators, 2-4-5-T, Arid lands, Simulated rainfall, Rates of application, Slopes, Surface waters.
Identifiers: *Herbicide efficiency, *Farm chemicals, *Dicamba, *Picloram, Plots.

The movement of farm chemicals via surface water has received increasing attention in the past decade. This study presents results from experiments conducted to determine the amount of herbicide in the runoff from small plots following simulated rainfall. The loss of 2-methoxy-3, 6-dichlorobenzoic acid (dicamba), 2,4,5-trichlorophenoxyacetic acid (2,4,5-T), and 4-amino-3,5,6-trichloropicolinic acid (picloram in runoff water was determined 24 hours after gas chromatograph and bioassays. When determined 24 hours after application, dicamba and picloram losses were greater from sod plots than from fallow plots, while 2,4,5-T losses were equal. Four months after application, herbicide losses averaged less than 1 percent of that lost 24 hours after application. The amount of picloram lost in a simulated rainfall of 0.5 inch varied with rate, but the percentage lost was the same. The percentage of picloram lost was influenced by slope of the plot and movement over untreated soil. The maximum loss obtained for any herbicide was 5.5 percent and the average was 3 percent. Tables show effect of slope, application rate, movement over untreated soil, and herbicide concentration in runoff water. (Popkin-Arizona)
W71-01716

NORTH-EAST COAL CO V HAYES (LIABILITY FOR DAMAGES TO FARM BY COAL MINE).
For primary bibliographic entry see Field 06E.
W71-01733

DIFFUSION OF HORIZONTAL BUOYANT JET DISCHARGED AT WATER SURFACE,
Tokyo Univ. (Japan).
Nobuyuki Tamai.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3, (Subject C), Science Council of Japan, Kyoto, p 215-222, 1969. 8 p, 2 fig, 1 tab, 7 ref.

Descriptors: *Jets, *Mixing, *Convection, *Turbulence, Diffusion, Heated water, Thermal pollution, Path of pollutants, Waste water disposal, Mathematical studies.
Identifiers: Free turbulent jets.

The mixing process of a two-dimensional horizontal warm-water jet was studied by extension of free turbulent jet theory to cases of flow with fluid density differences. The variation of the mean velocity of the discharged jet and variation of the thickness of the buoyant jet region can be predicted fairly well with the assumption of similarity of velocity and density distributions in the diffusion region. The proposed analysis may be applied in principle to the discharge of cooling water from power plants and to sewage disposal in the marine environment. (Knapp-USGS)
W71-01790

LABORATORY INVESTIGATION OF THE TURBULENT DIFFUSION IN OPEN CHANNEL BY MEANS OF SALT WATER INJECTION,
Seoul National Univ. (Republic of Korea). Dept. of Civil Engineering.
Soo Hahn Ahn.
In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C),

Science Council of Japan, Kyoto, p 343-352, 1969. 10 p, 8 fig, 7 ref.

Descriptors: *Path of pollutants, *Streams, *Waste disposal, *Mixing, Outlets, Turbulent flow, Turbulence, Dispersion, Diffusion, Tracers, Hydraulic models, Model studies, Flumes.
Identifiers: Turbulent diffusion, Korea.

When sewage effluent is discharged laterally into a river, the pollutant is transported not only to the longitudinal direction but also transversely by turbulence. The concentration distribution of pollutants in open channel was studied by means of salt water-injection in a flume model. The lateral concentration of salt follows the error curve. The rate of decrease of concentration along the side wall is commonly divided into three distinct zones. (Knapp-USGS)
W71-01809

POTOMAC RIVER WATER QUALITY, WASHINGTON, D.C. METROPOLITAN AREA.
Federal Water Pollution Control Administration, Cincinnati, Ohio. Div. of Technical Services.

Federal Water Pollution Control Administration Report, 1969. 80 p, 17 fig, 25 tab, append.

Descriptors: *Water pollution control, *Sewage treatment, *District of Columbia, Estuaries, Rivers, Water pollution sources, Virginia, Maryland, Standards, Pollution abatement.
Identifiers: *Potomac River.

This report reviews the status of water quality in the Potomac River estuary approximately one decade after a Federal Enforcement Conference was conducted on pollution of interstate waters of the Potomac River in the Washington metropolitan area. Six of nine major sewage treatment plants met recommendations that 80% BOD removal be accomplished. The District of Columbia (71.2%), Alexandria, Virginia (76.2%), and Fairfax County, Virginia's Westgate Plant (49.8%) failed. These three plants currently account for 94% of the BOD load discharged to the Potomac River. Effective disinfection of treated discharges was not accomplished. The District has made commendable progress in control of raw sewage discharges, but the recommended schedule of completion by 1966 was not met. Control of 39.6% of the raw sewage discharge has been accomplished and another 38.3% is now scheduled for control by 1969. Separation of the combined storm and sanitary sewers in progress that accounted for 22.1% of the total discharge is not scheduled for completion before the year 2000. Despite the advances, the Potomac River Estuary in the Washington metropolitan area remains grossly polluted due to inadequate sewage treatment, the rapid population growth, and the discharge of combined sewer overflows and raw sewage. Extremely high densities of bacteria from sewage are a threat to the health of all those who come in contact with the water of the river. (Knapp-USGS)
W71-01817

MICROBIAL DEGRADATION OF ORGANIC POLLUTANTS OF INDUSTRIAL ORIGIN,
Massachusetts Univ., Amherst.
For primary bibliographic entry see Field 05C.
W71-01898

CRITERIA FOR RECOGNITION OF ESTUARINE WATER POLLUTION BY AERIAL REMOTE SENSING,
Rhode Island Univ., Kingston. Dept. of Geology.
John J. Fisher.
Available from NTIS as PB-195 976, $3.00 in paper copy, $0.95 in microfiche. Technical Completion Report, Rhode Island Water Resources Center, 1970. 14 p. OWRR Project A-031-RI (1).

Descriptors: *Estuarine, *Photographic system, *Remote sensing, *Aerial photography, Water pollution sources, Pollutant identification.
Identifiers: *Infrared.

Multispectral aerial photographic remote sensing analysis was made of water quality in estuarine areas. Photographic interpretation was compared with 'ground-truth' data. Four film emulsions proved most efficient; panchromatic, black and white infrared, color and color infrared. A simple inexpensive four camera system using these films was designed and developed for this study. (Fisher-Rhode Island)
W71-01900

NATURAL OIL SEEPAGE AT COAL OIL POINT, SANTA BARBARA, CALIFORNIA,
General Research Corp., Santa Barbara, Calif., and California Univ., Santa Barbara. Dept. of Chemical Engineering.
Alan A. Allen, Roger S. Schlueter, and Paul G. Mikolaj.
Science, Vol 170, No 3961, p 974-977, November 1970. 4 p, 3 fig, 1 tab, 3 ref.

Descriptors: *Water pollution sources, *Oil, *Seepage, *Reservoir leakage, *Geologic control, Oil-water interfaces, Coasts, Beaches, Fractures (Geology), Path of pollutants, Ocean currents.
Identifiers: *Oil seepage (Natural), Santa Barbara Channel (Calif), Oil slicks.

Periodic references have been made in the past to natural submarine oil seeps in the Santa Barbara Channel, but this paper reports for the first time realistic estimates of surface pollution resulting from oil seeps at Coal Oil Point, California. The area is generally believed to be the most prolific natural seep of the many oil seeps in the Santa Barbara Channel. Aerial, surface, and underwater investigations reveal that the Coal Oil Point seeps discharge 50 to 70 barrels (8,000 to 11,000 liters) of oil per day into the Channel. The resulting slicks are several hundred meters wide, and tarry masses within these slicks frequently wash ashore. The predominant offshore currents in the area usually prevent oil from fouling the water and beaches, however, and the extent of natural seepage goes unnoticed by most people along the coast. (Lang-USGS)
W71-01904

STREAM DISPERSION AT SELECTED SITES,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02E.
W71-01914

SEPARATION OF OIL AND WATER WITH GRAVITY SEPARATOR (FRENCH),
Laval Univ., Quebec; and Hydraulic Research Inst., Bratislava (Czechoslovakia).
For primary bibliographic entry see Field 05G.
W71-01930

NICHOLS V FERNALD (UNREASONABLE USE OF FIRST RIGHTS IN SPRING).
For primary bibliographic entry see Field 06E.
W71-01953

DUCK-PROCESSING WASTE,
Robert S. Kerr Water Research Center, Ada, Okla.
Grover L. Morris.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No. SP-0366, Michigan State University, May 1966, p 15-18. 6 tab, 6 ref.

Descriptors: *Farm wastes, *Poultry, *Coliforms, Biochemical oxygen demand, Chemical analysis.
Identifiers: *Evisceration, Long Islands ducks, Waste loads.

Objectives of the study were (a) to measure and evaluate duck processing plant waste loads and (b) to observe plant operations for possible reduction in total water use by redistribution or by reuse of certain waters presently discharged to waste after one use, or by a combination of redistribution and reuse. Study of two duck-processing plants located on Long Island provides data pertaining to water use, waste loads, and general operation. The finished product is a high-quality duck of considerable delicacy. Water use in duck-processing plants seems high when compared with water used in chicken processing. Means of reducing the amount of water used are discussed. (See also W71-01992). (Christenbury-Iowa State)
W71-01994

STORMWATER RUNOFF FROM CATTLE FEEDLOTS,
Kansas State Univ., Manhattan.
J. R. Miner, L. R. Fina, J. W. Funk, R. I. Lipper, and G. H. Larson.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 23-27. 8 tab, 9 fig, 11 ref.

Descriptors: *Water pollution, *Detention reservoirs, *Farm waste, Waste storage, Nitrogen compounds, Organic waste, Rainfall intensity, Coliforms, Streptococcus, Chemical oxygen demand, Bacteria.
Identifiers: Rainfall duration, Feedlot runoff, Bacteriological activity, Kjeldahl nitrogen, Pollution potential.

Runoff characteristics from two experimental cattle feedlots were studied. Runoff was high-strength organic waste containing large quantities of nitrogenous compounds. The nitrogenous matter was being transformed continuously by bacteriological activity. More organic matter and Kjeldahl nitrogen were found in the runoff (a) with low-intensity rainfall, (b) with moist conditions preceding rainfall, and (c) during warm weather. Cattle feedlot runoff was a concentrated source of bacteria that normally are used to characterize water quality. Hydrologic characteristics of feedlot waste contribute to their stream-pollution potential. A detention pond seems feasible to prevent some of the slugging nature of the material. Diverting all rainfall not falling directly on the feedlot surface around the entire facility and maintaining lots so their litter remains as dry as possible were helpful in minimizing stream pollution potential. (See also W71-01992). (Christenbury-Iowa State)
W71-01997

FERTILIZERS AND FEEDLOTS — WHAT ROLE IN GROUNDWATER POLLUTION.

Agricultural Research, Vol 18, No 6, December 1969, p 14-15.

Descriptors: *Farm wastes, *Soil contamination, *Fertilizers, *Nitrates, Water pollution, Nitrogen, Nitrites, Aquifers, Colorado, Denitrification, Water table, Percolation.
Identifiers: *Feedlots, South Platte River Valley.

No significant contamination of the water table with nitrate from farm fertilizers or extensive cattle feeding operations was found in preliminary ARS studies in northeastern Colorado. But studies indicated that substantial amounts of nitrate could eventually reach the water table under heavily fertilized irrigated fields and under feedlots. ARS soil scientists measured nitrates in 129 soil cores drilled to bedrock or the water table and in 75 samples of groundwater taken with the cores in Colorado's South Platte River Valley. The investigators found that, on the average, the kind of land use did not effect the nitrate concentration of water entering the bottom of the holes where the cores were taken. The surface may contain more pollutants than water deeper in the aquifer. (White-Iowa State)
W71-02036

MODELING FEEDLOT RUNOFF POLLUTION,
Kansas State Univ., Manhattan. Dept. of Chemical Engineering; and Kansas State Univ., Manhattan. Dept. of Agricultural Engineering.
J. R. Miner, R. I. Lipper, and L. E. Erickson.
Transactions of the ASAE, Vol 10, No 4, p 497-501, 1967. 5 tab, 8 fig, 7 ref.

Descriptors: *Farm wastes, *Runoff, *Chemical oxygen demand, *Model-studies, Cattle, Water pollution, Hydraulic models, Discharge, Depression storage, Hydrographs, Hydrology, Rainfall intensity, Simulated rainfall.
Identifiers: *Feedlot, *Stirred tank with injection model, Concentration, Nonsurfaced lot, Concrete-surfaced lot, Soil cover complex number.

Most emphasis of this paper was on quality aspects of feedlot runoff; however a brief discussion of possible hydraulic models is given. Three concentration models are described and their ability to predict feedlot runoff water quality is shown. The three are, the stirred tank concentration model, stirred tank with injection concentration model, and the series-stirred tanks with injection concentration model. The three concentration models provided progressively better data representation as their complexity increased. Two experimental cattle feedlots especially designed for runoff investigation were used in the study. Associated with the feedlots were rainfall simulation and measuring equipment, and runoff measuring and proportional sampling facilities. One lot was concrete surfaced, the other had concrete only around feed bunks. Tempered by good judgement, feedlot models can be used to help predict organic concentration of runoff from a feedlot. When an improved hydraulic model is developed, it can be combined with either of the single, stirred tanks to provide a single feedlot model to predict overall water-pollution potential. (White-Iowa State)
W71-02040

EFFECTS OF FEED CONSUMPTION ON BIOCHEMICAL OXYGEN DEMAND OF STEER EXCRETA,
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
K. C. Mills, B. F. Parker, and I. J. Ross.
Transactions of the ASAE, Vol 12, No 1, 1969, p 133. 2 ref.

Descriptors: *Farm wastes, *Cattle, *Biochemical oxygen demand, Feeds, Silage, Grains, Pastures, Oxidation, Aerobic treatment, Sampling, Testing.
Identifiers: *Feed composition, Steers, Alsterberg modification, Winkler method.

The objective of the study on which the paper is based was to determine some of the effects of animal-feed composition of the rate of aerobic breakdown of animal waste. If differences in rate of aerobic breakdown occur because of feed composition, these differences should be proven by conducting biochemical oxygen demand tests on the wastes from animals on different feed. Thus excreta for BOD tests were obtained from three groups of steers being fed on all grain, grain and silage, and on pasture. The data for the pasture had much greater variability from week to week. Data on all tests are available in the original thesis and ASAE paper No. 67-930. It was concluded that the composition of animal feed will change the biochemical oxygen demand of animal excreta. This fact should be considered when designing aerobic systems for treating animal wastes. (White-Iowa State)
W71-02044

FARM WASTE DISPOSAL-AMENITY AND GOOD NEIGHBOURLINESS,
For primary bibliographic entry see Field 05E.
W71-02048

THERMAL POLLUTION CONTROL IN BAVARIA,
Bavarian Bureau of Water Supply and Pollution Control, Munich (West Germany).
For primary bibliographic entry see Field 05G.
W71-02071

MASONITE CORP V HILL (POLLUTION VICTIM MUST PROVE CERTAIN POLLUTANT CAUSED INJURY).
For primary bibliographic entry see Field 06E.
W71-02092

DAVIS V GARDEN HILLS CORP (PROPER MEASURE OF DAMAGES FOR POLLUTION OF STREAM).
For primary bibliographic entry see Field 06E.
W71-02093

KERBY V PRAIRIE PIPE LINE CO (INJURY TO CATTLE CAUSED BY OIL POLLUTION OF WATER).
For primary bibliographic entry see Field 06E.
W71-02128

THE COLOMBO (FEDERAL STATUTE PROHIBITING POLLUTION OF NEW YORK CITY HARBOR).
For primary bibliographic entry see Field 06E.
W71-02189

YASKILL V THIBAULT (LIABILITY OF LOWER RIPARIAN OWNER FOR BLOCKING STREAM).
For primary bibliographic entry see Field 06E.
W71-02199

5C. Effects of Pollution

QUANITATIVE DISTRIBUTION OF BENTHIC MACROFAUNA IN THE BLACK SEA,
Naval Oceanographic Office, Washington, D.C.
V. N. Nikitin.
Trans. of Trudy Inst. Okeanol., Vol. 69, p 285-329, 1964. Available from NTIS as AD-704 667, $3.00 in paper copy, $0.95 in microfiche. Naval Oceanographic Office Trans 461, 1969. 57 p.
Identifiers: *Ocean bottom, *Ecology, *Black Sea, *Marine biology, Distribution, Quantitative analysis, Population, Aquatic animals, Plants (Botany), Ocean bottom sampling, USSR, Translations, *Benthos.

The paper gives a comparative estimate for density of population and biomass of bottom macrofauna in different biocoenoses for separate regions of the Black Sea. Total benthos biomass has been calculated for all the eight vast regions of the sea which characterizes the 'productivity' level of these regions. The most productive regions appeared to be the northwestern part of the sea and in the sea region, adjoining the Roumanian coast. High productivity of the above regions results from the great volume of continental flow carrying large quantities of nutrients. For the entire life zone of the sea bottom, the total biomass of macrofauna (fish excepted) amounts to about 32,000,000 t. The average biomass of the benthic macrofauna for the entire sea will reach 305g/sq m.
W71-01683

VILLAGE OF ORRVILLE V GOCHNAUER (MEASURE OF DAMAGES FOR STREAM POLLUTION).
For primary bibliographic entry see Field 06E.
W71-01691

NORTH-EAST COAL CO V HAYES (LIABILITY FOR DAMAGES TO FARM BY COAL MINE).
For primary bibliographic entry see Field 06E.
W71-01733

COASTAL/ESTUARINE POLLUTION, AN ANNOTATED BIBLIOGRAPHY,
Ocean Engineering Information Service, La Jolla, Calif.
Evelyn Sinha.
Ocean Engineering Information Series, Vol 3, 1970. 87 p, 2 index.

Descriptors: *Abstracts, *Coasts, *Estuarine environment, *Water pollution, *Bibliographies, Publications, Water resources, Water management (Applied), Estuaries, Oceans, Bays, Coastal marshes.

This bibliography, intended as a guide in interdisciplinary studies of pollution in the coastal zone, contains 631 informative abstracts of literature providing substantial scientific and technological information on: the detection, identification, measurement and analysis of parameters of pollution and pollutants; sources of pollution; coastal and estuarine processes; effects of pollution; water quality management and waste heat utilization. A bibliography of bibliographies, separate identification of theses, books, patents, and detailed subject and author indexes are included. Represented are sources found in 111 journals, some 32 national and international conferences and symposia, governmental research and development reports, institutional studies and industrial contract reports. Coverage includes 1965 to May 1970. (Woodard-USGS)
W71-01788

DEMONSTRATION OF TOXIC SUBSTANCES BY USING THE FISH, LEBISTES RETICULATUS (DUTCH),
Utrecht Rijksuniversiteit (Netherlands).
Jan F. Reith, R. H. Frost, C. A. Schrijver, and R. J. A. M. Albers.
Pharmieutisch Weekblad 104, No 14, p 273-287, 1969. 9 tab, 26 ref.

Descriptors: *Dieldrin, *Bioassay, Age, *Toxicity, DDT, Carbamates pesticides, Phenolic pesticides, Lethal limit, Evaluation, Water pollution effects.
Identifiers: Guppies, *Lebistes reticulatus, Age differences, Sensitivity, *Toxic symptoms, Lindane, Chlordane, Phosphate esters, Sevin, Mercury compounds, Cadmium chloride.

Comparison of the effect of dieldrin on the sensitivity of 2 groups of L. reticulatus showed that 3-day-old guppies were more sensitive than 21-day-old guppies. The tests were carried out in 1-1. beakers contg. a previously reported British medium (1966). Five to 6 guppies were acclimatized at 23 for 45 min. in these beakers after which the toxic substance in 1 ml. acetone was added. The animals were observed for toxic symptons and the number of dead animals was recorded after 6 and 24 hours. The reproducibility of the results was good, although differences were observed between different generations and also between guppies from other sources. This est is esp. useful for testing pesticides (i.e. DDT, lindane, chlordane), while good results were obtained with phosphate esters, Sevin, carbamates, tetramethylthiuram disulfide and hg compounds. Other compounds toxic to guppies included: Cdcl2, phenothiazine, phenacetin strychnine, and others. Testing of the material was done after isolation of the toxic material from organs, stomach contents, and excreta. Some pesticides may cause 100% death in a conc. of 0.01 mg/l., and others only between 0.1 and 1 mg/l. Other toxic compds., (nonpesticides), such as medicines, may have a lethal effect between 3 and 10 mg/l. In many cases this test is less sensitive than the one with Drosophila melanogaster. (Katz-Washington)
W71-01859

STUDIES ON THE ACTION OF HIGH CONCENTRATIONS OF ALKYLPOLYGLCYCOL ETHERS ON FISH (GERMAN),
Ch. Gloxhuber, and W. K. Fisher.
Fd Cosmet. Toxicol. Vol 6, p 469-477, 1968. 10 fig, 24 ref.

Descriptors: Water pollution effects, *Detergents, Surface tension, Fishkill, *Toxicity, *Fish physiology, Fish behavior, Bioassay, Lethal limit, *Animal pathology, Mode of action.

Identifiers: *Alkylpolyglycol ethers, Nonionic detergents, Anionic detergents, *Histology.

In solutions of lethal concentrations of alkylpolyglycol ethers, belonging to the group of nonionic detergents, fish exhibit a picture of intoxication different from that in lethal solutions of anionic detergents. The reduction in the surface tension of the water seems to be the basic cause of the poisoning of fish by anionic detergents. The studies have shown that this largely applies also to the alkylpolyglycol ethers, but while the action of anionic detergents is limited to the gills, alkylpolyglycol ethers pass through the gills and are absorbed. The course of the intoxication resulting from action on the gills corresponds to that following absorption through the peritoneal cavity. The symptoms of poisoning after absorption of alkylpolyglycol ethers show a marked similarity to those due to detracaine and procaine, the type and course of the narcotic symptoms being like those already known to local anaesthetics. (Katz-Washington)
W71-01860

INTERACTION OF ANTIMYCIN A AND ROTENONE IN FISH BIOASSAYS,
Bureau of Sport Fisheries and Wildlife, La Crosse, Wis. Fish Control Lab.
Robert M. Howland.
The Progressive Fish-Culturist, Vol 31, No 1, p 33-34, 1969. 1 tab, 4 ref.

Descriptors: *Antimycin A, *Rotenone, Fish control agents, Rainbow trout, Sunfishes, *Bioassay, Toxicity, Fish management, Lethal limit, Compatibility, Rehabilitation, Water pollution effects.
Identifiers: *Interactions, LC50.

Bioassays utilizing rainbow trout and bluegill sunfish were conducted with Antimycin A, rotenone, and a combination of rotenone and antimycin A to determine whether interaction does occur, and, if so, whether it intensifies or nullifies toxicity. The toxic effect of antimycin A is manifested more slowly than that of rotenone. The combination of antimycin A and rotenone is more toxic than either alone. No nullifying interaction occurs upon admixture. For Antimycin A, rotenone, and the combination of 96 hour LC50's for rainbow trout are 0.032 ppb, 57.0 ppb, and 0.027 ppb Antimycin A and 31 ppb Rotenone, respectively. For bluegills these values are 0.157 ppb, 114 ppb, and 0.112 ppb Antimycin A and ppb rotenone. (Katz-Washington)
W71-01862

TOXICITY OF RHODAMINE B AND FLUOREXCEIN SODIUM TO FISH AND THEIR COMBATABILITY WITH ANTIMYCIN A,
Bureau of Sport Fisheries and Wildlife, La Crosse, Wis. Fish Control Lab.
Leif L. Marking.
The Progressive Fish-Culturist, Vol 31, No 3, p 139-142, 1969. 2 tab, 10 ref.

Descriptors: *Compatibility, *Antimycin A, *Bioassay, *Toxicity, Dye releases, Evaluation, Rainbow trout, Channel catfish, Sunfishes, Fish toxins, Fish control agents, Lethal limit, Water pollution effects.
Identifiers: *Rhodamine B, *Fluorescein sodium, Fluorescent organic dyes, LC50, Interactions.

Bioassay using rainbow trout, channel catfish, and bluegill were conducted with rhodamine B, fluorescein sodium and mixtures of these dyes with antimycin A were conducted. The 96-hour LC50 of Rhodamine B to rainbow trout, channel catfish, and bluegill is 217 ppm, 526 ppm and 379 ppm respectively. For fluorescein sodium these values are 1,372 ppm, 2, 267 ppm, and 3, 433 ppm. The data indicate that less antimycin is required to kill rainbow trout when it is combined with 100 ppm of rhodamine B. Similarly, less antimycin is required to kill catfish when it is combined with 5 ppm of rhodamine B. In contrast, more antimycin is required to kill bluegills when combined with 5 ppm of fluorescein. No conclusive reasons are given for these differences. The author feels that both dyes are relatively non-toxic to fish. (Katz-Washington)
W71-01863

THERMAL TOLERANCE OF JUVENILE SALMON IN RELATION TO NITROGEN SUPERSATURATION,
Bureau of Commercial Fisheries, Seattle, Wash. Biological Lab.
Wesley Ebel, Earl M. Dawley, and Bruce Monk.
Report, September 1970. 28 p, 5 tab, 7 fig, 11 ref, append.

Descriptors: *Nitrogen gas, *Thermal tolerance, *Salmon, Juvenile fish, Water pollution effects, Mortality, Laboratory equipment, History, Thermal pollution.
Identifiers: *Super saturation, *Oncorhynchus kisutch, *O. tschawhytscha, and *Salmo gairdneri.

Described are the results of experiments designed to determine the effect of supersaturation of nitrogen gas on thermal tolerance of 3 species (Oncorhynchus kisutch, O. tschawhytscha, and Salmo gairdneri) of juvenile salmonids. The data indicated that tolerance of all 3 species at all acclimation temperatures was lowered and that LE50 rates were accelerated when supersaturation of nitrogen at 125-130 percent was present in the test water. Increasing the depth of the test tanks allowed the fish to compensate somewhat for the supersaturation by sounding, but substantial mortalities still occured. Tests revealed that coho were the most tolerant, chinook next, and steelhead the least tolerant to temperature increases in the presence of supersaturation of nitrogen. (Wahtola-Washington)
W71-01864

INTERACTING EFFECTS OF GAMMA RADIATION AND SODIUM HALIDE CONCENTRATIONS ON RAINBOW TROUT,
Utah State Univ., Logan. Center of Ecology.
John M. Nouhold, and R. K. Sharma.
Symposium on Radioecology, Proceedings of the Second National Symposium on Radioecology, Ann Arbor, Michigan, p 142-151, May 15-17-1967. 3 tab, 9 fig, 15 ref. CONF-670503.

Descriptors: *Radiation (Gamma), *Sodium halides, *Rainbow trout, Mortality, Laboratory equipment, Water pollution effects.
Identifiers: *Interactions, *137Cs, Sodium fluoride, Sodium chloride, Sodium bromide, Sodium iodide.

The objective of the experiment was to investigate the effects of gamma ray doses and halide concentrations on rainbow trout survival, and to develop possible explanations for the patterns of mortality, that result from these interactions. Mortality of 137 Cs gamma irradiated rainbow trout subjected to aquarium medium levels of sodium fluoride, sodium chloride, sodium bromide and sodium iodide displayed significant response to either time by gamma dose, time by sodium halide concentration, of gamma dose by sodiumhalide concentration interactions. The interactions were concluded to be caused by radiation induced changes in oxygen uptake and sodium uptake and excretion. (Wahtola-Washington)
W71-01865

INFLUENCE OF DISSOLVED OXYGEN AND CARBON DIOXIDE ON SWIMMING PERFORMANCE OF LARGEMOUTH BASS AND COHO SALMON,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
Michael L. Dahlberg, Dean L. Shumway, and Peter Doudoroff.
Journal of the Fisheries Research Board of Canada, Vol 25, No 1, p 49-70, 1968. 2 tab, 6 fig, 26 ref. U.S. Public Health Service. Grant WP-00135.

Descriptors: *Dissolved oxygen, *Carbon dioxide, *Swimming performance, *Large mouth bass, *Coho salmon, Water temperature, Laboratory equipment, Length, Weight, Stream flow, Juvenile fish, Water pollution effects.
Identifiers: *Relationships, Physiology, Alkalinity.

The final swimming speed of juvenile largemouth bass, Micropterus salmoides was reduced markedly at oxygen concentrations below 6 or 6 mg/liter in tests at 25C. At levels about 6 mg/liter, the final swimming speed was virtually independent of the oxygen concentration. The performance of bass that had been acclimated overnight to elevated carbon dioxide levels was not materially affected by the highest tested concentrations of free carbon dioxide. For juvenile coho salmon, Oncorhynchus kisutch at temperatures near 20 C and carbon dioxide concentrations near 2 mg/liter, any considerable reduction of the oxygen concentration from about 9 mg/liter, the air-saturation level, resulted in some reduction of the final swimming speed. The performance of the salmon was impaired much more markedly than was that of the bass by the same reduction of the oxygen concentration. At oxygen concentrations near and above the air-saturation level, high concentrations of free carbon dioxide averaging 18 and 61 mg/liter had a depressing effect on the final swimming speed of coho salmon even after overnight acclimation. No measurable effect of free carbon dioxide concentration near 61 mg/liter was evident at 2 mg/liter dissolved oxygen, and concentrations near 18 mg/liter had little or no effect even at moderately reduced dissolved oxygen levels after overnight acclimation of the salmon to these carbon dioxide concentrations. (Wahtola-Washington)
W71-01866

INFLUENCE OF OXYGEN CONCENTRATION ON THE GROWTH OF JUVENILE LARGEMOUTH BASS,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
Nelson E. Stewart, Dean L. Shumway, and Peter Doudoroff.
Journal of the Fisheries Research Board of Canada, Vol 24, No 3, p 475-494, 1967. 3 tab, 4 fig, 16 ref. U.S. Public Health Service. Grant wp-00135.

Descriptors: *Dissolved oxygen concentration, *Growth rates, *Largemouth bass, Food conversion efficiency, Juvenile fish, Laboratory equipment, Temperature, Food consumption, Fluctuations, Water pollution effects.
Identifiers: *Interactions, Earthworms.

Several experiments are reported on the influence of nearly constant dissolved oxygen concentrations, both below and above the air-saturation level, and of wide diurnal fluctuations of oxygen concentration on the appetite, growth, and food conversion efficiency of juvenile largemouth bass, Micropterus salmoides. The fish were fed unrestricted rations of small, live earthworms throughout the six experiments, whose duration was usually 15 days. The growth rates and food consumption rates of the bass increased markedly with an increase of the constant oxygen concentrations to levels near the air-saturation level, and declined with further increase of oxygen concentrations. Gross food conversion efficiencies were considerably reduced only at concentrations well below 4 mg/liter. The growth of bass subjected alternately to low and higher oxygen concentrations for either equal or unequal portions of each 24-hr day was markedly impaired. It was almost always less than that which presumably would have occured had the fish been held at a constant concentration equal to the mean concentrations to which the fish had been exposed. (Wahtola-Washington)
W71-01867

THE USE OF COPPER SULFATE AS A MEDICAMENT FOR AQUARIUM FISHES AND AS AN ALGAECIDE IN MARINE MAMMAL WATER SYSTEMS,
California Academy of Sciences, San Francisco. Steinhart Aquarium.

Robert P. Dempster, and William H. Shipman.
Occasional Papers of the California Academy of Sciences, No 71, 1969. 6 p, 2 fig, 4 ref.

Descriptors: *Copper sulfate, Algicides, *Toxicity, *Aquaria, Fish management, Fish parasites, Chem-control, Resistance, *Fish diseases, Protozoa, Analytical techniques, Regression analysis, Epizootiology, Water pollution effects.
Identifiers: *Gill diseases, Therapy, Oodinium.

This paper describes the use of copper sulfate to control algae and fish ectoparasites in marine aquaria. The method introduced in this paper prevents copper precipitation in alkaline water, thus permitting copper ions to be maintained in-solution. Copper compounds must be utilized with considerable caution since they are toxic to all forms of life. Therefore, a technique is given by which, once the concentration of copper in the water system is adjusted, sequestered copper is added at a rate sufficient to maintain the concentration. This procedure has been used for the last 15 years at the Steinhart Aquarium, and as a result there has been no outbreak of fish disease. Copper concentrations up to 1 ppm have been used. (Katz-Washington)
W71-01868

LOBSTERS UNHARMED BY OIL POLLUTION.
Fisheries Research Board of Canada, St. Andrews (New Brunswick).

Fisheries of Canada, Vol 22, No 10, p 20, 1970.

Descriptors: Water pollution effects, Oily water, *Oil wastes, *Taste, *Lobsters, Emulsifiers, Public health.
Identifiers: *Oil pollution, Chedabucto Bay, Nova Scotia.

Tests have shown that oil pollution in Nova Scotia's Chedabucto Bay does not appear to be affecting lobsters. Simulated tests have included the coating of lobsters with bunker oil and feeding lobsters herring coated with oil. Taste test have indicated no tainting of lobster meat. Experiments carried out with oil dispersants also appeared not to have affected the lobsters. (Sjolseth-Washington)
W71-01869

BIOENVIRONMENTAL AND RADIOLOGICAL SAFETY FEASIBILITY STUDIES ATLANTIC-PACIFIC INTEROCEANIC CANAL. FINAL REPORT, TERRESTRIAL ECOLOGY,
Georgia Univ., Athens. Inst. of Ecology.
Frank B. Golley, John T. McGinnies, and Richard G. Clements.
Available from NTIS as BMI-171-24, $3.00 in paper copy, $0.95 in microfiche. Battelle Memorial Institute, May 29, 1969. 80 p. Contract AT (26-1)-171.
Identifiers: *Ecology, Nuclear explosion, *Radiological contamination, Terrain, *Inland waterways, Ecology, Feasibility studies, Inland waterways, *Nuclear excavation, Atlantic Pacific Interoceanic Canal.

In 1966, the University of Georgia, Institute of Ecology, contracted with Battelle Memorial Institute, Columbus, Ohio, to carry out studies in terrestrial ecology in Panama and Colombia. These were part of the bioenvironmental and radiological-safety feasibility studies for an Atlantic-Pacific interoceanic canal authorized under Public Law 88-609, 88th Congress. One objective of the overall study was to determine the best route for, and the feasibility of, constructing a sea-level canal between the Atlantic and Pacific Oceans by nuclear excavation. The objective of the University of Georgia, Terrestrial Ecology program, was to determine the movements of potential radionuclides produced by construction in the terrestrial ecosystems adjacent to the proposed canal routes. Analysis of the movement of radioisotopes through terrestrial ecosystems required information on the concentration and cycling of elements. Since radioactive tracers could not be used and present fallout levels in the ecosystems of interest were very low, it was necessary to follow the cycle of nonradioactive elements. The determination of stable-element cycling in the terrestrial ecosystems required information on the kinds of ecosystems, their biomass, and mineral standing crops. The ecosystems were conceived as a series of compartments: overstory leaves, overstory stems, understory leaves, understory stems, fruits and flowers, epiphytes, litter, roots, soil, herbivores, carnivores, and detritivores. Each compartment was visualized as having a capacity and inputs and outputs. The capacity was defined as the quantity of biomass and/or element contained within the compartment; transfer functions were calculated from the input and output rates. Sixty-three tables are presented to show results. (See also W71-01884)
W71-01883

BIOENVIRONMENTAL AND RADIOLOGICAL-SAFETY FEASIBILITY STUDIES: ATLANTIC-PACIFIC INTEROCEANIC CANAL. DARIEN FISH DIETARY,
Battelle Memorial Inst., Columbus, Ohio.
James A. Duke, and Ann W. Rudolph.
Available from NTIS as BMI-171-23, $3.00 in paper copy, $0.95 in microfiche. 13 June, 1969. 150 p. Contract AT (26-1)-171.
Identifiers: *Marine biology, *Ecology, *Panama, *Inland waterways, Atlantic ocean, Pacific ocean, Radiobiology, *Atlantic Pacific Interoceanic Canal.

A preliminary discussion is presented concerning kinds of freshwater and marine fish used as food by man, bait used for fishing, methods of fishing, and types of fish eaten at different seasons. The body burdens of 55Fe in people who eat Alaskan marine fish were found to be several times higher than those of caribou-eating eskimos. A brief review of the literature on food habits of fish is given, and there is a discussion of the role of fish in food chains and mixing of faunas. The importance of sea grass (Thalassia sp.) as food for fish and invertebrates is discussed. An extensive list of freshwater and marine fish found or expected in Panama and adjacent Colombia with notes on their uses and feeding habits is presented. Both scientific and common names are included. A bibliography of approximately 150 references is appended. (See also W71-01883)
W71-01884

MICROBIAL DEGRADATION OF ORGANIC POLLUTANTS OF INDUSTRIAL ORIGIN,
Massachusetts Univ., Amherst.
Haim B. Gunner.
Available from NTIS as PB-195 982, $3.00 in paper copy, $0.95 in microfiche. Project Completion Report, October 15,1970. 11 p, 11 ref. OWRR Project A-020-MASS (4).

Descriptors: *Diazinon, *Hydrolysis, *Rhizosphere effect, Organophorous, Compounds, Copper, *Microorganisms, *Biodegradation, Degradation (Decomposition), Water pollution sources, Organic pesticides, Industrial wastes, *Organophorous pesticides, Insecticides, Water pollution effects.
Identifiers: Microbial ecosystems, Organic pollutants.

The disappearance of Diazinon was compared in sterile and non-sterile water systems. Chemical hydrolysis was pH related. Kinetic studies showed the maximum hydrolysis rate at pH 3.5 with the minimum at neutrality. The presence of metals, particularly copper, enhanced hydrolysis. Maximum hydrolysis was achieved in the presence of native microflora and under natural systems. These are shown to be the primary agents in the degradation of the Diazinon molecule. Diazinon and its derivatives were found to effect a profound and sustained disequilibration in microbial ecosystems. The basis of this population selection was found to be the selective inhibition of susceptible populations by Diazinon in their dissimilation of a wide range of carbon substrates. Studies of population interactions between higher plants and microflora established that the rhizosphere effect hitherto reported only for terrestrial plants applies equally to an aquatic milieu. Studies with anaerobic microflora showed that Diazinon was nutritionally inaccessible as a carbon source and in addition was an inhibitory agent. The nature of inhibition was diffuse and appeared to result from a general disruption of the cell membrane. (Gunner-Mass)
W71-01898

BIOLOGICAL INTERRELATIONSHIPS BETWEEN FECES AND FLIES,
California Univ., Berkeley.
For primary bibliographic entry see Field 05D.
W71-01996

PROBLEMS OF CATTLE FEEDING IN ARIZONA AS RELATED TO ANIMAL-WASTE MANAGEMENT,
Arizona Univ., Tucson. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 05D.
W71-02027

SEA GRANT ACTIVITIES.
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 09D.
W71-02054

THERMAL POLLUTION-BIOLOGICAL EFFECTS, A REVIEW OF THE LITERATURE OF 1969,
Water Pollution Control Federation, Washington, D.C.
Charles C. Coutant.
Journal of Water Pollution Control Federation, Vol 42, No 6, p 1025-1057, June 1970. 200 ref.

Descriptors: *Biological communities, *Thermal pollution, Temperature, Biogeography, Resistance, Reproduction, Growth rates, Animal physiology, Animal diseases, On-site investigations, Bibliographies.
Identifiers: *Synergism, *Polymorphism.

This article reviews the literature of 1969 on the biological effects of thermal pollution. It sites a number of other reviews published during 1969 dealing with temperature effects in aquatic ecosystems, industrial thermal discharges, and subtle responses of organisms to temperature changes. The main topics covered are the biological problems associated with biogeography, synergism, resistance, reproduction, polymorphism, feeding, growth, temperature selection, physiology, disease, primary production, waste assimilation, and beneficial uses. Another topic covered briefly is on-site field studies of biological effects resulting from thermal discharges. (Osborne-Vanderbilt)
W71-02055

HEAT REJECTION REQUIREMENTS OF THE U. S.,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
R. T. Jaske, J. F. Fletcher, and K. R. Wise.
Chemical Engineering Progress, Vol 66, No 11, p 17-22, Nov 1970. 7 fig, 2 tab, 10 ref.

Descriptors: *Cooling water, *Thermal pollution, Environment, Optimization, Electric power, Forecasting, Cooling towers, Evaporation, Control.
Identifiers: Heat rejection, Thermal pollution, Environment, Optimization, Electric power, Forecasting, Cooling towers, Evaporation, Control.

Currently only 20% of total environmental heat loads originate from electrical production. Even conversion to a total electric automobile economy would cut the total energy release to the environment by a factor of two because at projected efficiency growths in the electrical industry 50% ther-

mal efficiency appears a barely achievable goal under current energy policies. By the year 2000 A.D., a 300% increase in total energy release is projected to occur over present values the incremental electric capacity of 1,060 gigawatts for the years 1970-2000 will require a consumptive flow of 31,200 cu ft/sec of water for evaporation alone which is about twice the flow of the entire Colorado River Basin. Simulation modeling is fully capable of predicting and evaluating thermal effects and without advance simulation, the decisions on plant size, level of treatment, treatment options, and plant location can be forced to produce built-in economic disadvantages (such as cooling towers) to the detriment of an already deteriorating rate structure. By use of appropriate tax incentives such as an energy depletion allowance, such wasteful energy consumers as the disposable container, the internal combustion automobile engine, uninsulated structures, incineration of wastes, an nonregenerative air-conditioning systems could be brought into some semblance of control. (Upadhyaya-Vanderbilt)
W71-02062

CHANGING EMPHASIS IN THE SITING OF STEAM ELECTRIC POWER STATIONS,
Oak Ridge National Lab., Tenn.
M. M. Yarosh.
American Society of Mechanical Engineers Winter Annual Meeting, New York, Nov 29-Dec 3, 1970. 8 p, 3 fig, 2 tab, 28 ref.

Descriptors: *Thermal pollution, *Cooling water, Sites, Electric power plants, Forecasting, Water, Aquatic environment, Population, Transmission lines, Costs, Legislation.
Identifiers: Sulfur oxides, Waste heat.

Over the next 30 years, total electric power consumption is projected to increase by about a factor of 5 or 6. Considering the economics the power plants should be located near the load center, should have an adequate fuel supply and adequate source of cooling water at acceptable temperature, and adequate land of suitable topography on which to site the powerplant is essential. Other considerations in siting are area economics, tax base and local citizen attitude towards the powerplant, etc. By 1990, it is estimated that there will be a total of approximately 300 fossil fuel plant sites and 200 nuclear plant sites of over 500 mw capacity. Heating of receiving water bodies reduces the maximum oxygen carrying capacity at the system while simultaneously increasing biological and biochemical oxygen demands within the system. Under current growth projections, the emission rates for sulfur oxides from electric power plants will rise from the 12 million tons per year in 1965 to over 100 million tons per year by the turn of the century. Over the next 20 years about 10,000 miles of 765-kv lines will be required, together with an additional 190,000 miles of other transmission lines. Underground power transmission lines are potentially more acceptable but cost 10 to 20 times more than conventional overhead transmission. Productive use of waste heat, advanced practices in siting and policies and new directions are also described in brief. (Upadhyaya-Vanderbilt)
W71-02063

THE EFFECT OF TEMPERATURE ON THE LIFE CYCLE, GROWTH AND FECUNDITY OF BRANCHIURA SOWERBYI (OLIGOCHAETA: TUBIFICIDAE),
Reading Univ. (England). Dept. of Zoology.
R. J. Aston.
Journal of Zoology, London, N. 154, p 29-40, 1968. 7 fig, 22 ref.

Descriptors: *Thermal pollution, Oligochaetes, Tubificids, Growth rates, Life cycles, Water temperature, Sexual maturity, Heated water.
Identifiers: River Avon, River Thames, Warmed habitats, Branchiura cocoon.

Branchiura sowerbyi Beddard was probably imported into Britain with tropical aquatic plants consigned to botanic gardens. The British populations occur mainly in artificially warmed habitats. Data on the temperature relations of Branchiura was collected from a life cycle study in the field from observations on the life cycle of worms in cultures reared in semi-field conditions and from laboratory experiments on the growth and fecundity of worms over a range of constant temperatures. The life cycle of Branchiura was completed in about a year at natural temperatures in the river Avon and in warm conditions in a power station effluent discharged into the river Thames. Cocoons were produced in spring and summer and most of the worms had attained sexual maturity by March of the following year. These worms probably died during the cocoon laying season. Laboratory experiments showed that the optimum temperature for cocoon production was 25C for both the Thames and Avon population. Growth in sexually mature worms was fastest at 10C in the Avon population and 15C in the Thames population but in immature worms growth was most rapid at about 30C. It followed that at high temperatures a high rate of cocoon production retarded growth in sexually mature worms. (Upadhyaya-Vanderbilt)
W71-02066

THE PRODUCTION OF ZOOPLANKTON IN SOUTHAMPTON WATER,
Southampton Univ. (England).
For primary bibliographic entry see Field 02L.
W71-02070

TEMPERATURE EFFECTS ON THE SORPTION OF RADIONUCLIDS BY FRESHWATER ALGAE,
Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
R. S. Harvey.
Health Physics, Pergamon Press, Vol 19, Aug 1970, p 293-297. 4 fig, 3 tab, 7 ref.

Descriptors: Temperature, Sorption, Radioisotopes, Algae, Growth rates, Thermal pollution.
Identifiers: Savannah River Plant, Culture media, Dry weight, Thermal effects.

The species studied were collected from the reactor effluent streams at Savannah River Plant. Unialgal cultures were developed in inorganic media. All tests were conducted using the continuous flow culture system described by Watts and Harvey. Water temperatures of 23, 26, 29 and 32C had no significant effect on the sorption of 137Cs, 85Sr, 65Zn, 59Fe, 57Co and 54Mn by the filamentous green alga Stigeoclonium lubricum. Radionuclide concentrations in the unicellular diatom Navicula seminulum were 2-5 times higher at 32C than those obtained at lower temperatures. Water temperatures of 25, 30, 35, 40C had no significant effect on the sorption of 137Cs, 85Sr, 65Zn and 59Fe by the filamentous blue-green alga Plectonema boryanum. However, 57Co concentrations in P. boryanum decreased with temperature, and 54Mn concentrations increased from 25 to 35C. Growth rates of N. seminulum and P. boryanum were inhibited at 32 and 25C, respectively. Growth of S. lubricum was not influenced by the temperatures tested. These data show that nonlethal changes in water temperature had no major influence on the sorption of essentiall elements by the algae studied. (Upadhyaya-Vanderbilt)
W71-02075

A PRELIMINARY EVALUATION OF THE THERMAL EFFECTS OF THE BEN FRANKLIN DAM PROJECT ON COLUMBIA RIVER TEMPERATURES BELOW THE HANFORD PLANT,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
R. T. Jaske.
AEC Research and Development Report No BNWL-733, VC-2, April, 1968. 33 p, 21 fig, 3 tab, 10 ref. USAEC Contract AT (45-1)-1830.

Descriptors: *Thermal pollution, *Temperature, *Reservoirs, Density currents, Weather data, Model studies.
Identifiers: Hanford plant, Ben Franklin dam, Travel time, *Digital simulation, River profiles, *Temperature transient.

Using the Hanford plant operations record for the year 1966, and the weather record for the same period, a series of simulation runs was made to determine the effects of the dam on the temperature regime, and the extent to which density currents could be expected to develop. This information is to be used as background for the later evaluation of the modification of the existing radionuclide discharge. The digital simulation model, colheat, was used. Operations with the model, using the data period indicated showed that the existence of the proposed project would have nominal effect, tending towards a slight increase in downstream temperature for both the 385 and 400-ft pool elevations. Under some conditions, in critical temperature seasons (April and September), plant operations cause amplification of about 10C maximum of the temperature transients associated with stream regulations and plant load factor. The 385-ft pool can be considered a channel flow case for estimating travel time. However, density currents could be expected in the 400-ft pool for most of the summer months, thus causing decreased travel time and relatively adiabatic thermal conditions for the main flow system at the lower end of the reservoir. (Upadhyaya-Vanderbilt)
W71-02076

MASONITE CORP V HILL (POLLUTION VICTIM MUST PROVE CERTAIN POLLUTANT CAUSED INJURY).
For primary bibliographic entry see Field 06E.
W71-02092

ENGINEERING EVALUATION OF VIRUS HAZARD IN WATER.
American Society of Civil Engineers. Sanitary Engineering Div.
For primary bibliographic entry see Field 05A.
W71-02112

KERBY V PRAIRIE PIPE LINE CO (INJURY TO CATTLE CAUSED BY OIL POLLUTION OF WATER).
For primary bibliographic entry see Field 06E.
W71-02128

CHAPTER IV: OPTIMUM INVESTMENT IN WATER POLLUTION CONTROL.
For primary bibliographic entry see Field 06B.
W71-02134

5D. Waste Treatment Processes

PLAQUING AND IMMUNOLOGICAL METHODS FOR DETECTION AND IDENTIFICATION OF ENTEROVIRUSES,
Arizona Univ., Tucson. Dept. of Microbiology and Medical Technology.
For primary bibliographic entry see Field 05A.
W71-01651

AREAWIDE SEWERAGE MASTER PLAN REPORT: PHASE I - INVENTORY SUMMARY REPORT.
Denver Regional Council of Governments, Colo.

Available from NTIS as PB-190 446, $3.00 in paper copy, $0.95 in microfiche. Summary Report, February 1970. 111 p, 5 tab, 8 fig. HUD Project Colo P-77.
Identifiers: *Urban planning, *Sewage, *Colorado, Urban planning, Inventory, Urban areas, Sanitary engineering, Tables, Diagrams, Maps, Population, Wastes (Industrial), Water supplies, Water pollution, *Denver (Colo).

This report summarizes an inventory of sewerage agencies and facilities in the Denver Metropolitan Area. Sewerage information is presented for four groups of agencies: the Metropolitan Denver Sewage Disposal District No. 1 and its members and connectors; other core area agencies; Englewood-Littleton and connectors; and Boulder area agencies. This report is the first report of a continuing areawide sewerage master plan study. Subsequent phases will include analysis of sewerage information and preparation of an areawide sewerage master plan.
W71-01679

AREAWIDE SEWERAGE MASTER PLAN REPORT FOR THE DENVER METROPOLITAN AREA. PHASE I (INVENTORY).
Denver Regional Council of Governments, Colo.

Available from NTIS as PB-191 197, $3.00 in paper copy, $0.95 in microfiche. Denver Regional Council of Governments, March 1970, various pagings. HUD Colorado Project P-77.
Identifiers: *Urban planning, *Colorado, *Sewage, Urban areas, Management planning, Public health, Control, Industries, Area planning and development, Sewers, Denver (Colo), Sewage treatment facilities, Public utilities.

The report summarizes an inventory of sewerage agencies and facilities in the Denver Metropolitan Area.
W71-01687

APPLICATION OF IONIZING RADIATION TO THE TREATMENT OF WASTE WATERS AND SEWAGE SLUDGE,
Gulf General Atomic, Inc., San Diego, Calif.
D. M. J. Compton, Sandra J. Black, F. L. Lieurance, and W. L. Whittemore.
Available from NTIS as GA-9632, $3.00 in paper copy, $0.95 in microfiche. GA-9632, August 8, 1969. 22 p, 48 ref. AEC Contract AT (04-3)-167.
Identifiers: *Waste water treatment, *Sewage treatment, *Dissolved organic matter, *Sewage, *Radiation chemistry, *Nuclear industrial applications, Sewage, Costs, Ionization.

Direct radiation oxidation of organic impurities in waste waters is not an economically competitive process, since the G values (number of single-electron-transfer oxidations per 100 e V of ionization energy deposited) measured are too low and since the oxidation process becomes ineffective at low concentrations of impurities. The use of irradiation as a conditioning agent in sludge filtration is also economically noncompetitive, since similar results can be obtained with small amounts of chemical conditioning agents, and since the conditioning produced by irradiation saturates at too low a value to be useful. Irradiation does produce potentially useful effects in enhancing the settling of sludge, but the effect is unpredictable. Further work on this topic is proceeding.
W71-01695

PLAN FOR PUBLIC SEWERAGE FACILITY DEVELOPMENT.
Rhode Island Statewide Comprehensive Transportation and Land Use Planning Program, Providence.

Available from the NTIS as PB-192 947, $3.00 in paper copy, $0.95 in microfiche. Report No 11, September 1969. 92 p, 10 tab, 13 fig.
Identifiers: *Urban planning, *Rhode Island, *Sanitary engineering, Urban planning, Economics, Water pollution, Management planning, Sewage, Costs, *Regional planning and development, *Sewers.

This report represents an effort to plan for the future development of sewerage facilities on a statewide basis in relation to the physical, economic and social development of the state. The plan sets forth the framework necessary to provide for the future development of sewerage facilities to promote the future growth and economic development of Rhode Island and the need to control and reduce the pollution of the state waterways. The planning period extends to the year 1990, beginning with a short range plan from the present to the year 1975, and a long range plan commencing in 1975 and covering the period to the year 1990. The major parts of the report include: (1) the role of the state in sewerage facility planning; (2) present extent of public sewerage systems in Rhode Island; (3) future sewerage system requirements; (4) statewide plan for the future development of sewerage facilities; (5) short range and long range plan cost estimates; and (6) implementation of the sewerage facility development plan.
W71-01700

DECARBONATION AND DEAERATION OF WATER BY USE OF SELECTIVE HOLLOW FIBERS,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Environmental Sciences.
Charles A. Cole, and Emil J. Genetelli.
Environmental Science and Technology, Vol 4, No 6, p 514-517, June 1970. 1 tab, 3 fig, 8 ref.

Descriptors: *Membrane processes, *Water reuse, *Deaeration, Dissolved oxygen, Permeability, Gases, Equations, Waste water treatment.
Identifiers: *Hollow fibers, *Pervaporation, *Decarbonation, Volatile pollutants.

Pervaporation or gas-liquid separation using selective membranes as a potential new unit operation for water and waste water treatment is discussed. Studies involving this process for decarbonation and deaeration are described. The basic separation theory is presented and further developed according to Fickian diffusion theory and Henry's Law. The bench-scale laboratory process consisted of feeding distilled water to which 500-700 mg/l carbonate (as CaCO3) was added through a bundle of 5000 hollow fibers (45r o d and 25r i d) constructed similarly to a tube heat exchanger. The separated CO2 and O2 were removed from the fiber surface by vacuum or nitrogen gas sweep. Effectiveness of the system was evaluated in light of CO2 concentration, temperature and fiber material. It was found that polypropylene fibers were most efficient and removed more than 96% of the dissolved oxygen and 99% of the alkalinity at feed concentrations of 7.6 mg/l and 250 mg/l (as CaCO3) respectively. It was estimated that these same results could be achieved in a flow of 10,000 gpd by using 7.7 cu ft of polypropylene separator at a 20 deg C operating temperature and a specific surface area of 9000 sq ft/cu ft. (Sorber-Texas)
W71-01756

GAUGING AND SAMPLING INDUSTRIAL WASTE WATER (OPEN CHANNEL),
Department of Water Resources, New York. Bureau of Water Pollution Control.
For primary bibliographic entry see Field 05A.
W71-01757

ANAEROBIC TREATMENT OF WASTES,
Kansas Univ., Lawrence. Dept. of Civil Engineering.
Raymond C. Loehr.
Developments in Industrial Microbiology, Vol 9, p 160-174, 1968. 5 fig, 32 ref.

Descriptors: *Anaerobic digestion, *Anaerobic conditions, *Waste water treatment, *Organic loading, *Nutrient requirements, Organic waste.
Identifiers: *Solids retention time, *Temperature effects, *Buffer capacity, *Waste mixing.

Almost all naturally-occuring organic matter and many synthetic organic compounds can be fermented, or digested anaerobically and when carried out to completion, the main end products are methane and carbon dioxide. Anaerobic digestion is thought to occur in a series of steps, the two most important steps being the conversion of complex organics to simple organic material and the conversion of simple organics to gaseous end products, predominantly methane and carbon dioxide. The basic factors that should be evaluated when considering anaerobic waste treatment include: (1) mixing, (2) solids retention time, (3) availability of nutrients, (4) buffer capacity, (5) loading and (6) temperature. Solids retention time is of greater importance in anaerobic systems than in aerobic systems. The minimum solids retention time increases with decreasing temperature and has been estimated at 3-5 days for systems operating at 35 deg C and in the range of 15-20 days for systems operating at 15 deg C. There are four basic processes that can be employed for anaerobic waste treatment: (1) single stage, (2) two stage, (3) two stage with sludge return, and (4) the anaerobic filter. Each of these processes are discussed. Two stage with sludge return and the anaerobic filter are processes that can maintain high solids retention time values while permitting small unit volumes and high loading rates. This article also discussed anaerobic systems for solid wastes, including industrial and animal waste, for dilute organic waste, and for soluable organic waste. (Waid-Texas)
W71-01758

PERVAPORATION OF VOLATILE POLLUTANTS FROM WATER USING SELECTIVE HOLLOW FIBERS,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Environmental Sciences.
Charles A. Cole, and Emil J. Genetelli.
Journal Water Pollution Control Federation, Vol 42, No 8, Part 2, p R290-R298, August 1970. 2 tab, 10 fig, 8 ref.

Descriptors: *Membrane processes, *Ammonia, *Waste water treatment, Water reuse, Permeability, Gases, Equations.
Identifiers: *Hollow fibers, *Pervaporation, *Volatile pollutants, Ammonia separation.

Studies involving pervaporation or gas-liquid separation using selective hollow fibers for the removal of ammonia from a water solution are described. Ammonia removal by this method was investigated as an alternative to sir stripping at elevated pH. It was found that nylon was more selective for removal of ammonia than was polypropylene or Dacron. The basic separation theory is presented and further developed as a result of this study according to Fickian diffusion and Henry's Law. The process used involves feeding synthetic ammonia water through a bundle of hollow fiber separators constructed similarly to a tube heat exchanger with the separated ammonia being removed from the fiber surface by vacuum or nitrogen gas sweep. Effectiveness of the system was evaluated in light of ammonia concentration, temperature, fiber material, pressure differential and alternate sweep materials. Under optimum conditions, it was found that a 90% removal of an initial ammonia concentraion of 50 mg/l in a 10,000 gpd stream would require a separator volume of 271 cu ft. assuming an operating temperature of 20 deg C, a nylon separator and 9,000 sq. ft./cu. ft. specific surface area. Although the process has been demonstrated to be feasible it appeared less promising than results of previous studies which indicated that 99% of an initial 250 mg/l alkalinity (as CaCO3) could be removed using 7.7 cu ft. of polypropylene separator under identical conditions. (Sorber-Texas)
W71-01759

FERMENTATION INDUSTRY-PHARMACEUTICAL, CORN, SUGAR, (LITERATURE REVIEW),
Oklahoma State Univ., Stillwater.
A. F. Gaudy, Jr.
Journal Water Pollution Control Federation, Vol 42, No 6, p 1160-1162, June 1970. 11 ref.

Descriptors: *Waste water treatment, *Yeasts, *Biochemical oxygen demand, *Aerobic treatment, *Organic waste, Anaerobic digestion, Lagoons.
Identifiers: *Distillery waste.

The results of pilot-plant studies on aerobic biological treatment of a distillery waste was reported and aerated lagoons were selected as the method of treatment yielding an average BOD removal efficiency of 91.5%. Another report evaluated loading parameters for anaerobic digestion of distillery waste and concluded that higher organic loadings could be digested successfully when using diluted rather than raw (undiluted) waste water. The production of yeasts can both cause and help solve waste water problems. A report reviewed methods for handling waste water from yeast production, and the use of yeast for the treatment of wastes. It has proved effective in treatment of amino acids, leucine and glutamic acids, mono-, di-, and hydroxy-carboxylic acids. The effects of holding time and pH on the removal of BOD from a potato starch waste was reported. Longer holding times and an increase in pH in the range 4 to 9 provided greater BOD removals. A report discussed various tests for estimating organic matter in effluents and outlined a modified permanganate oxidation method applicable to sugar mill waste. An alternative procedure was given for wastes containing significant amounts of nitrogenous materials. The results were correlated with 5-day BOD values. (Waid-Texas)
W71-01760

MEAT AND POULTRY PROCESSING WASTES (LITERATURE REVIEW),
Battelle Memorial Inst., Columbus, Ohio.
John H. Litchfield.
Journal Water Pollution Control Federation, Vol 42, No 6, p 1162-1165, June 1970. 12 ref.

Descriptors: *Poultry, *Waste water treatment, *Aerobic treatment, *Organic waste, Biochemical oxygen demand, Aeration, Anaerobic digestion, Lagoons, Heat treatment.
Identifiers: *Slaughterhouse waste treatment.

Several reports summarized waste treatment methods for meat processing plants. They emphasized the necessity of assuring that pathogenic organisms were destroyed or inactivated during treatment processes so that they would not reach receiving streams. One report presented an evaluation of the treatment of hog slaughtering wastes using aerated and anaerobic lagoons. BOD, grease, and suspended solids removal in the total system were 69.0, 98.2, and 96.2% respectively. The use of heat treatment of slaughterhouse wastes for BOD reduction was investigated. Best BOD and total nitrogen reduction were achieved in the range of 100 deg to 120 deg C. Another treatment method using a series of stabilization ponds and an aeration pond was discussed. The recirculated material from the aeration pond was reported to be useful as a soil conditioner. Aerated ponds were also found to be suitable for treating poultry waste. The process reduced the BOD from 800 to 1000 mg/l in the influent to less than 30 mg/l in the final effluent. An extended aeration treatment system and a baffled oxidation pond system were both used for a combined chick hatchery, poultry processing plant, and by-products plant and the results were reported. A final report described an aerated lagoon system for treating mink food manufacturing waste, consisting of horse meat, ripe, frozen liver, fish, poultry scrap, cereal and water. BOD reduction of 90% was obtained with a construction cost of $114.50/lb BOD. (Waid-Texas)
W71-01761

EVALUATION OF FACILITY OPERATION (LITERATURE REVIEW),
Grand Rapids, Mich.
Doris M. Voshel.
Journal Water Pollution Control Federation, Vol 42, No 6, p 969-971, June 1970. 10 ref.

Descriptors: *Treatment facilities, *Waste water treatment, *Biological treatment, Cost efficiencies, Biochemical oxygen demand, Activated sludge, Suspended solids, Chlorination.

Descriptions of new facilities and improvement of exisiting facilities of several treatment plants were described. New surface aerators in Greece, New York treatment plant resulted in more efficient mixing and thus more oxygen transfer increasing overall BOD removal from 70.8% to 81.7% and suspended solids removal from 76.8% to 83.9%. The expanded secondary treatment plant at Beloit, Wisconsin employs a unique sludge press and oval concrete aeration tanks providing a high performance second-stage purification facility and a proving grounds for a new concept in treatment equipment. Welland, Ontario completed an ultra-modern pollution control plant with an average capacity of 8 mgd and peak design flow of 20 mgd. The cost of the treatment facility was $2.35 million and $5.5 million for a new connecting trunk sewer system. The primary plant was designed to remove 95% grit, 70% setteable solids, and 30% BOD. The sludge is digested, thickened and vacuum filtered. The water pollution control plants of other cities were described giving removal efficiencies and costs. (Waid-Texas)
W71-01762

CONCENTRATION OF DILUTE PULPING WASTES BY REVERSE OSMOSIS AND ULTRA FILTRATION,
Institute of Paper Chemistry, Appleton, Wis.
Averill J. Wiley, George A. Dubey, J. M. Holderby, and A. C. F. Ammerlaan.
Journal Water Pollution Control Federation, Vol 42, No 8, Part 2, p R279-R289. 3 fig, 3 tab, 6 ref.
FWQA Grant 12040 EEL.

Descriptors: *Reverse osmosis, *Pilot plants, *Pulp and paper industry, *Water reuse, Pulp wastes, Biochemical oxygen demand, Chemical oxygen demand, Dissolved solids, Reynolds number, Color, Waste water treatment.
Identifiers: *Ultrafiltration, Membrane fouling, Membrane scaling, Inorganic ion, Velocity.

Pilot plant scale studies in the waste treatment capabilities of the reverse osmosis process for the concentration of dilute effluents of the pulp and paper industry are reported. Three demonstrations involving calcium sulfite, ammonia, sulfite and neutral sulfite wastes are discussed and the test results are analyzed. The pilot unit was designed to handle waste volumes of between 20,000 to 100,000 gpd under field conditions when operating at 600 psi with the prospect of the concentrate stream containing 7 to 10% solids. Average data indicated that the unit rejected more than 98% of color; 88 to 97% of inorganic primary pulping ions (Ca, Na, NH3); 87 to 95% of chemical oxygen demand and dissolved solids; and 70 to 88% of BOD. BOD rejection was found to be less for wastes containing low molecular weight organic volatiles. Operating problems including membrane fouling and sealing, membrane life and membrane flux regeneration are discussed. Cost estimates are provided for full-scale operations on the basis of these studies. (Sorber-Texas)
W71-01763

DISINFECTION (LITERATURE REVIEW),
Cincinnati Univ., Ohio. Dept. of Civil Engineering.
Riley N. Kinman, and H. A. Faber.
Journal Water Pollution Control Federation, Vol 42, No 6, p 949-952, June 1970. 22 ref.

Descriptors: *Chlorination, *Disinfection, *Chlorine, *Radiation, Waste water treatment, *Disinfection.
Identifiers: Bromine, Rapid sand filtration.

Several reports have discussed the various chlorine-providing compounds utilized for disinfection of waste water. The characteristics and costs of each were discussed and it was found that equal results might be obtained in waste water disinfection with either chlorine or the kypochlorites. The effects of chlorine on algae and different viruses were presented. Complete algae kill was caused by 10 mg/l chlorine at 2 hour contact. A combined chlorine residual of 40 mg/l (measured amperometrically) provided 99.99 percent destruction of the type I poliovirus in settled waste water with 30 minutes contact time. The studies indicated that present chlorination practices (1 mg/l residual) were totally inadequate for a high level of virus inactivation. Several reports investigated the use of radiation for disinfection treatment of waste water. It was found that without synergistic effect, radiation disinfection cost using Cobalt 60 would be prohibitive for general waste water treatment. Different types of methods for disinfection of waste water were outlined including the use of bromine, chlorine-bromine, and iodine, as well as chlorine. One report studied the removal of nematodes by rapid sand filtration since present methods of disinfection (chlorination) seemed to have little effect on the distruction of nematodes. The predominant factor in determining the percent of nematode removal was the percent of motile nematodes in the influent regardless of sand size. (Waid-Texas)
W71-01764

WASTE TREATMENT BY AEROBIC TECHNIQUES,
Department of National Health and Welfare, Kingston (Ontario).
Peter M. Higgins.
Developments in Industrial Microbiology, Vol 9, 1968, p 146-159. 9 fig, 4 tab, 13 ref.

Descriptors: *Aerobic treatment, *Activated sludge, *Lagoons, *Trickling filters, *Sewage treatment, *Aeration, Anaerobic digestion, Cost, Sludge, Waste water treatment.
Identifiers: Dispersed growth, Modified activated sludge process, Extended aeration, Contact stabilization, Complete mixing.

In biological systems microorganisms continuously remove organic matter from liquid waste by synthesis into new protoplasm. The activated sludge process biologically degrades waste, through aeration into microbial mass. The active mass is separated in clarifiers then either discharged or recycled and the clear effluent is discharged to the receiving stream or given further treatment. Several basic activated sludge process variants: dispersed growth, high rate or modified, conventional, total, oxidation or extended aeration, contact stabilization and complete mixing are discussed. In trickling filters the removal of organic matter is accomplished by adsorption at the surface of biological slimes covering the filter media. The adsorbed organic compounds are hydrolized and utilized by the attached slimes for growth and energy. Variations of the trickling filters were described, including low rate, high rate and super rate filters. The third aerobic process discussed was lagoons in which aerobic conditions are produced by algae. It has been shown however that conventional ponds are actually 75% anaerobic at all times. (Waid-Texas)
W71-01765

PHYSICAL AND CHEMICAL METHODS (LITERATURE REVIEW),
Federal Water Pollution Control Administration, Cincinnati, Ohio.
Jesse M. Cohen.
Journal Water Pollution Control Federation, Vol 42, No 6, p 971-983, June 1970. 88 ref.

Descriptors: *Reclaimed water, *Reclamation, *Tertiary treatment, Demineralization, Adsorption, Coagulation, Flocculation, Sedimentation, Flotation, Filtration, Ion exchange.
Identifiers: Phosphorus removal, Polymeric flocculants, Precipitating agents.

Reports were given discussing the use of physical-chemical processes in waste water treatment. Among the topics presented were water supply, water quality requirements, waste water treatment, and methods of sludge disposal. The reclaimed water was then utilized in a variety of applications in industry, i.e., cooling and irrigation. A variety of

chemical techniques for phosphorus removal was presented which included precipitation with aluminum, ferric salts, lime, sodium aluminate and polyelectrolytes. The advantages, disadvantages and costs of these techniques were given. Several pilot plant studies evaluated the carbon adsorption process and summarized a full-scale application. A report also described a laboratory-scale reactivation unit for powdered activated carbon. A variety of reports presented different aspects of the coagulation-flocculation process. The studies included the use of alum and lime as coagulants, the effect of particle size on turbidity removal, and the interactions of colloidal dispersions with electrolytes. The cost and effectiveness of synthetic flocculants were also evaluated. Sedimentation and flotation were the subject of several reports. The tube clarification process, microflotation techniques, foam separation of powdered activated carbon, and removal of Chlorella ellipsoidea from suspension were investigated and reported. (Waid-Texas)
W71-01766

WATER RECLAMATION AND REUSE (LITERATURE REVIEW),
Clemson Univ., S.C. Dept. of Environmental Systems Engineering.
Thomas M. Keinath.
Journal Water Pollution Control Federation, Vol 42, No 6, p 952-963, June 1970. 77 ref.

Descriptors: *Water reuse, *Reclaimed water, *Reclamation, Flotation, Filtration, Foam fractionation, Chloronation, Activated carbon, Diatomaceous earth, Electrodialysis, Reverse osmosis, Waste water treatment.
Identifiers: *Municipal waste water reclamation, *Industrial waste water reclamation, Ammonia stripping, Recarbonation-stabilization, Microstraining, Flash evaporization.

Because of the convergence of the diminishing supply of water and the expanding demands placed on that supply, the advanced-level treatment and reuse of waste water has gained increasing recognition as a keystone to total water resources management. Several reports discussed the concepts of water resource development including importation, conservation, total use, and reuse. Programs for municipal waste water reclamation of several cities were outlined including provisions for flotation, ammonia stripping, recarbonation-stabilization, sand filtration, foam fractionation, chlorination, and activated carbon filtration. General aspects of industrial waste water reclamation were discussed and treatment processes for a variety of different industries were outlined. More rigid requirements for waste water disposal have intensified the reuse of water and intensified the interest in various unit processes that might be utilized for renovating waste waters to meet effluent and/or reuse criteria. Several reports discussed in detail and gave cost information for various advanced-level unit operations. Included in these discussions were microstraining, diatomaceous earth filtration, dual-media filtration, adsorption on granular activated carbon, chemical oxidation, flash evaporation, electrodialysis, freezing, reverse osmosis, phosphate precipitation, and air-stripping of ammonia. Waste water reclamation by indirect cycle through irrigation and direct injection for groundwater recharge was also discussed. (Waid-Texas)
W71-01767

COAL AND COAL MINE DRAINAGE (LITERATURE REVIEW),
Bituminous Coal Research Inc., Monroeville, Pa.
James F. Boyer.
Journal Water Pollution Control Federation, Vol 42, No 6, p 1179-1185, June 1970. 49 ref.

Descriptors: *Coal mine waste, *Coal mines, *Water pollution sources, *Water pollution treatment, *Acid mine water, Cost, Hydrologic aspects, Waste water treatment.
Identifiers: *Acid mine drainage, Strip mine lakes, Lime slurry, Mine drainage pollution control.

The Bituminous Coal Research, Inc. compiled a bibliography of abstracts which were published by the Pennsylvania Department of Mines and Mineral Industries. The most comprehensive report, prepared by the Appalachian Regional Commission gave an in-depth study of the sources, occurrences, control techniques and impact on public facilities of acid mine drainage in Appalachia. The report estimated a cost of $6.6 billion for mine drainage pollution control and abatement. Several other reports documented the effect of mine drainage on water quality and groundwater in smaller geographic areas. The formation of acid mine drainage including all reaction from the oxidation of pyrite to the subsequent release of acidity, was the subject of several reports. The reports indicated that pyrite is rapidly oxidized by ferric ions, and oxygen was necessary only for the oxidation of ferrous ions which is a slower reaction and thus the rate determining step. Reports discussing the treatment of acid mine drainage indicated processes using a lime slurry or limestone proved to be the most economic and practical. Reports involving special treatment problems were also presented. They included high ferrous iron content mine water treatment, use of inert gases to eliminate acid pollution from abandoned deep mines and the effectiveness of mine drainage pollution control measures, as applied at an abandoned mine site. (Waid-Texas)
W71-01768

WASTE WATER AND STORM FLOW TREATMENT (LITERATURE REVIEW),
D. J. Weiner.
Journal Water Pollution Control Federation, Vol 42, No 6, p 963-969, June 1970. 42 ref.

Descriptors: *Waste disposal, *Sewerage, *Sewers, *Overflow, *Municipal waste, Waste water treatment.
Identifiers: Sewerage systems, Stormwater, Storm sewers.

The role of waste water transportation, control, and treatment was being reemphasized as part of the requirements in improved control and improvement of the environment. New communities have demanded sewerage services and older municipalities expanded sewage facilities into new areas as they found that residents expected to receive adequate sewage services. Sewers continue in importance as an economical and efficient means of waste disposal. Several reports presented various aspects and problems connected with different types of pipes for sewage use. These included clay pipes, concrete pipes, asbestos concrete pipes and PVC pipes. Maintenance programs and safety programs were described in several papers. Also presented were construction programs incorporating pipe testing and root control methods for new and renovated sewers. The control and treatment of overflows from combined sewers have attracted attention and interest of several papers as the total water pollution control program grows. Regulation and treatment of overflows have been investigated in the United States and other countries. A variety of programs in several cities for treatment of the combined sewer overflows were discussed. (Waid-Texas)
W71-01769

CONTROL MECHANISMS OPERATIVE IN A NATURAL MICROBIAL POPULATION SELECTION FOR IT'S ABILITY TO DEGRADE L-LYSINE,
Oklahoma State Univ., Stillwater. Bioengineering Labs.
C. P. L. Grady, Jr., A. F. Gaudy, Jr., and Elizabeth T. Gaudy.
Applied Microbiology, Vol 18, No 5, p 776-784, November 1969. 5 fig, 2 tab, 21 ref. FWPCA Grant WP-00786.

Descriptors: *Microorganisms, *Bacteria, *Control, *Maintenance, *Growth rate, *Chemical oxygen demand, Inhibition, Enzymes, Waste water treatment.
Identifiers: *Induction, *Repression, *Catabolite-repression, Lysine, Bacterial population, Replica ploting, Enzymatic capacity, Substrate concentration.

The purpose of the study is to discover the nature of certain metabolic control mechanisms such as induction, repression and catabolite repression in microbial populations. A natural microbial population was selected in a medium containing L-lysine as the sole carbon source and ammonia as the nitrogen source. Experiments were performed at room temperature. Cells were harvested from a batch-operated fermentor containing lysine and were grown through one transfer on lysine, glucose or a mixture of lysine and glucose. By comparing the substrate removal rates and enzymatic capabilities of the cells, it was determined that inducible enzyme systems responsible for lysine degradation were subject to catabolite repression. It was noted that the presence of flucose in the medium decreased the differential rate of activity of the cultures. Results of replica ploting showed that all species in the population were capable of participating in the overall response. Glucose represented the formation of the inducible lysine degrading system and metabolic intermediates also exerted the effect. Glucose had no inhibitory effect upon the activity of preformed enzymes. Preinduction by lysine offered only a small degree of protection against repression, but omission of ammonia-nitrogen from the system did not overcome it. (Shankar-Texas)
W71-01838

PAPER AND ALLIED PRODUCTS (LITERATURE REVIEW),
Tufts Univ., Medford, Mass.
George W. Gove, and I. Gellman.
Journal Water Pollution Control Federation, Vol 42, No 6, p 1138-1160, June 1970. 128 ref.

Descriptors: *Industrial wastes, *Waste water treatment, *Pulp and paper industry, Water pollution, Biology, Instrumentation, Reverse osmosis, Water reuse, Sludge, Activated sludge, Lagoons, Trickling filters, Ponds.
Identifiers: *Physical-chemical treatment.

Effects of federal and state legislation pertaining to air and water pollution of pulp and papermaking is discussed. The increasing severity of: black liquor spills, color, foam, training of operating personnel, improving sludge handling, technology, etc. is discussed. Factors affecting the appearance of surface waters including natural phenomena were reviewed. The use of ocean outfalls for disposal of pulp mill wastes were studied to determine the dilution and dispersant characteristics of existing effluents through the use of aerial photogrammetry techniques and flourimetric analysis. Several investigations were made on the biochemical oxygenation characteristics of cellulose fibers, the organisms responsible for the degradation of pulp and paper wastes, and the ecological effects of discharging these wastes to rivers. Several method for monitoring the treated effluent are discussed for a wide variety of parameters. A large number of methods are discussed for pulping liquor disposal and recovery; these include the uses of chemical treatment for recovery, reverse osmosis, by-processing, and a wide variety of physochemical treatment methods. The potential reuse of water from many of the sub-systems within paper mills is appraised. Various mill facilities are described in regard to the secondary treatment processes including activated sludge, oxidation lagoons, aerated stabilization basins, trickling filters, and spray irrigation. (Hancuff-Texas)
W71-01839

REMOVAL OF ORGANIC NITRILES FROM WASTE WATER SYSTEMS,
Vanderbilt Univ., Nashville, Tenn. Dept. of Environmental and Water Resources Engineering.
Philip A. Lutin.
Journal Water Pollution Control Federation, Vol 42, No 9, p 1632-1642, September 1970. 1 fig, 7 tab, 6 ref.

Descriptors: *Waste water treatment, *Organic compounds, *Industrial wastes, Activated sludge, Oxidation.
Identifiers: *Nitriles, *Cyanides, Removals.

Oxidation of organic nitriles were reflected by oxygen uptake measured on Warburg constant-volume respirometers. Three activated sludges from different types of aerobic treatment plants in the Nashville, Tennessee area were run with each of the nitriles tests. The organic nitriles tested were divided into 3 groups: (1) mononitriles, (2) dinitriles and (3) aromatic nitriles. The alkanes and monocarboxylic acids corresponding to the nitriles with regard to the number of carbon atoms in the molecules were studied to determine the effect of terminal grouping on biological oxidation. At a concentration of 500 mg/l mononitriles are toxic or very resistant to biological oxidation at 6 hours and 24 hours. At the same concentration dinitriles are toxic or extremely resistant to biological oxidations for detention times up to 72 hours. Aromatic nitriles showed a toxic effect on all three sludge and strongly resisted biological oxidation. Presence of the cyanide group reduces the susceptibility of a molecule to biological oxidation by activated sludge. (Hancuff-Texas)
W71-01840

PERFORMANCE OF DEEP TRICKLING FILTERS BY FIVE METHODS,
Regional Inst. of Tech., Jamshedpur (India).
V. Hanumanulu.
Journal Water Pollution Control Federation, Vol 42, No 8, p 1446-1457, August 1970. 2 fig, 5 tab, 17 ref.

Descriptors: *Trickling filters, *Waste water treatment, *Design, *Performance, Sewage treatment, Filters, Data collection, Efficiencies.
Identifiers: *Formulas, Recirculation.

The applicability of five methods for predicting the performance of deep trickling filters were studied: Velz, National Research Council, Ten States, Eckenfelder, and Galler and Gotaas. It was concluded that Velz law cannot be applied beyond a filter depth of 6 feet or where there is recirculation. The NRC formula underestimates the performance because the full effect of the depth of the filter is brought into play by recirculation. Efficiency calculated by the Ten States formula depended only on recirculation and in comparison with Velz and NRC formulas predictes results that are closer to observed values. The Eckenfelder formula gave the best predicted values in the case of filter with recirculation. Efficiencies predicted by the Eckenfelder formula in the case of a filter without recirculation are far from the actual case. The values predicted by the Galler and Gotaas formula are only slightly better than those found by the Eckenfelder formula in the case of a filter without recirculation. In the case of a filter with recirculation, the Galler and Gotaas formula is close to the Eckenfelder formula. If the Galler and Gotaas formula is modified so that the depth term exponent is a linear function of recirculation volumn it becomes equally applicable to filters with and without recirculation. (Hancuff-Texas)
W71-01841

SEPTIC TANK SYSTEMS,
Brown and Caldwell, San Francisco, Calif.
J. A. Cotteral, Jr., and D. P. Norris.
Journal of the Sanitary Engineering Division, Proceedings American Society of Civil Engineers, Vol 95, No SA1, 715-746, February 1969. 4 fig, 5 tab, 39 ref.

Descriptors: *Design, *Septic tanks, *Sewage disposal, *Maintenance, Design criteria, Design standards, Drainage systems, Performance, Pollution abatement, Sewage treatment, Soil disposal fields, Soil properties, Waste water treatment.
Identifiers: *Drainfields, Capacity, Requirements.

In areas without community sewerage, the installation of individual sewage disposal systems ranges from simple cesspools to complex aerobic treatment units. The most common type of individual sewage disposal system consists of a septic tank and drainfield. The historically high failure rate of septic tank systems has shown them to be unreliable and unpredictable. However, it is possible to design, construct and operate systems in suitable areas for which a high degree of reliability over a reasonable life period can be expected. A minimum septic tank capacity of 1200 gal. should be provided, with an additional 250 gal. per bedroom for homes larger than four bedrooms. Septic tanks should be water tight, constructed of reinforced concrete or precast concrete with reinforced top, and should be 2-compartment tanks of standard proportions as required by the USPHS Manual of Septic Tank Practice. Septic tanks should receive all domestic, laundry, and sanitary wastes, but should exclude roof and area drainage and groundwater. Tanks should have a minimum of 8 in. of cover. Drainfield trenches should be a minimum of 12 in. and a maximum of 18 in. wide and not less than 50 ft nor more than 100 ft. in length. A loading rate of 600 sq. ft. per bedroom is recommended. (Aguirre-Texas)
W71-01842

FOAM SEPARATIONS FOR INDUSTRIAL WASTES: PROCESS SELECTION,
Kentucky Univ., Lexington. Dept. of Chemical Engineering.
Robert B. Grieves.
Journal Water Pollution Control Federation, Vol 42, No 8, Part II, p R336-R344. 7 fig, 2 tab, 18 ref.

Descriptors: *Industrial wastes, *Foam separation, *Chromium foam fractionation, Waste water treatment, Air, Aeration, Costs, Design, Chemical precipitation.
Identifiers: *Treatment processes, Flotation, Chemical removal, Clarification.

Foam separations have been shown to be feasible in a number of waste treatment applications. Two parameters, one a concentration ratio and the other a quantity ratio have been indicated to be particularly useful in evaluating the effects on the extent of separation of key independent variables. Frequently the process choice may be left to the design engineer. In this case he should select a process involving the flotation of colloidal or already precipated particles as opposed to the foam fractionation for ion flotation of soluble species. A variety of operational modifications are available. The two state precipitation flotation of Cr (III) hydroxide is a feasible process for the treatment of chronium wastes, with an operating cost of $0.67/lb Cr. An additional choice to be made is that between dissolved air and dispersed air foam separation. For the removal of sediments from natural waters the operating costs are $0.50/1000 gal for dispersed air and $0.60/1000 gal for dissolved air, producing excellent calcification of very turbid waters. (Hancuff-Texas)
W71-01843

ECONOMIC TRANSPORT OF DIGESTED SLUDGE SLURRIES,
Rand Development Corp., Cleveland, Ohio.
Bertram C. Raynes.
Journal Water Pollution Control Federation, Vol 42, No 7, p 1379-1386, July 1970. 2 fig, 2 tab, 31 ref.

Descriptors: *Sludge, *Transportation, *Costs, *Sludge disposal, Design, Pipelines, Land reclamation, Slurries, Waste water treatment.
Identifiers: *Digested sludge.

Pipeline transport of digested sludge to disposal areas located at considerable distance from the generating treatment plant may offer the waste water plant operators substantial economic benefits. The cost savings of transportation of the digested slurry is related to the distance, the quantity, the solids concentration and other variables. The sludge slurries vary in flow behavior as a function of solids concentration. At solids concentrations above 5% they behave as Bingham plastics while below 5% their behavior is Newtonian. Pipelining in the Newtonian region should be the most economical procedure despite the increased volumn of material to be transported. Even where dilution is practiced the quantity of digested sludge available from many waste water treatment plants dictates the use of pipelines perhaps as small as 2 inches in diameter. Another purpose of this investigation is to encourage the use of digested sludge slurries in the reclamation of land areas in need of revegatative assistance and in particular those strip mine areas or similar land areas that constitute water pollution problems in themselves. (Hancuff-Texas)
W71-01844

OPTIMUM WASTE TREATMENT PLANT DESIGN UNDER UNCERTAINTY,
Wisconsin Univ., Madison. Dept. of Civil Engineering.
Paul M. Berthouex, and Lawrence B. Polkowski.
Journal Water Pollution Control Federation, Vol 42, No 9, p 1589-1613, September 1970. 9 fig, 8 tab, 32 ref.

Descriptors: *Waste water treatment, *Optimization, *Sewage treatment, *Design, Systems analysis, Costs, Statistics, Constraints, Activated sludge, Computer programs.
Identifiers: Uncertainty, Variants, Algorithms, Sensitivity.

Simple methods for evaluating the different sources of uncertainty that face the design area of waste treatment systems and incorporate waste treatment systems are outlined. The methods incorporated these evaluations into a systems optimization scheme. The design of the individual treatment plant is reviewed. Use of various estimates for the parameters to estimate uncertainty in process performance is discussed. A model of the activated sludge process is developed relating to the performance of primary and final clarifier. Formulas for developing cost data are presented. Penalty costs were used to simplify the calculations and force the optimum design to meet certain constraints. The Hooke-Geeves method is presented and discussed as an easily implimented method. (Hancuff-Texas)
W71-01845

INFLUENCE OF DOMESTIC WASTE WATER PRETREATMENT ON SOIL CLOGGING,
Toronto Univ. (Ontario). Dept. of Civil Engineering.
R. Laak.
Journal Water Pollution Control Federation, Vol 42, No 8, Part I, p 1495-1500, August 1970. 2 fig, 2 tab, 9 ref.

Descriptors: *Sewage treatment, *Soils, *Waste water treatment, Percolation, Biochemical oxygen demand, Effluents, Aerobic treatment, Anaerobic conditions.
Identifiers: *Clogging, Suspended solids, Plugging.

Increase pretreatment of domestic waste water prior to soil application resulted in reducing the clogging rate of the soil surface. A laboratory study with 30 soil columns, 3 different soils and septic tank and extended aeration effluent was carried out. The soils were intermitantly loaded at 80 minute intervals with the effluent up to clogging failure which was reached within 180 days. The service of the soil surfaces was increased when the concentration of total suspended solids, BOD and the hydraulic loading were decreased. Total failure load expressed by the sum of total suspended solids and BOD was directly related to the non-capillary porosity of the soils. (Hancuff-Texas)
W71-01847

TREATMENT OF FRUIT PROCESSING WASTE BY AERATION,
Gray and Osborn, Yakima, Wash.

Larry A. Esvelt, and Hearbert H. Hart.
Journal Water Pollution Control Federation, Vol 42, No 7, p 1305-1326, July 1970. 13 fig, 5 tab, 16 ref. FWQA Grant WPRD 58-01-68.

Descriptors: *Industrial wastes, *Aeration, *Fruit crops, *Activated sludge, Waste water treatment, Biological treatment, Operations, Nutrients, Costs, Tanneries, Efficiency, Lagoon.
Identifiers: *Fruit processing, Growth.

The waste treatment system of a cooperative fruit processing cannery was studied for two operating seasons to determine treatment efficiency and to establish parameters for the treatment of liquid fruit processing wastes by aeration. The cannery processes pears, peaches, apples, and other fruits in a lesser amount. The facilities operate at a flow of 0.5 to 2.5 mgd and up to 25,000 lbs per day of BOD. Activated sludge or contact stabilization treatment of fruit processing waste at low rates will provide greater than 90% removal of organic load and solids from the effluent. Aerated lagoon treatment can provide greater than 80% BOD removal but suspended solids remain in the effluent. Final clarification is successful by low surface loading rates, less than 400 gpd per sq. foot. Nutrient addition is necessary to achieve successful treatment. The cost of the treatment is estimated at $0.41 per pound of BOD removed from aerated lagoons, $0.061 per pound of BOD removed from activated sludge and $0.067 per pound of BOD moved from contact stabilization. Data were collected on biological substrate assimilation, sludge growth, oxygen uptake and sludge settability. Constants were obtained for substrate removals, sludge growth rate, endogenous respiration and oxygen requirements. (Hancuff-Texas)
W71-01848

MEASUREMENT AND SIGNIFICANCE OF ADENOSINE TRIPHOSPHATE IN ACTIVATED SLUDGE,
Florida Univ., Gainesville. Dept. of Environmental Engineering.
Ames W. Patterson, Patrick L. Brezonik, and Hugh D. Putnam.
Environmental Science and Technology, Vol 4, No 7, p 569-575, July 1970. 10 fig, 1 tab, 25 ref.

Descriptors: *Activated sludge, *Energy, *Biomass, Sewage treatment, Waste water treatment, Microbiology, Laboratory tests, Metabolism, Productivity.
Identifiers: *Adenosine triphosphate, Organisms, Theory.

A method for adenosine triphosphate (ATP) measurement in activated sludge has been developed from the firefly reaction of luciferin, luciferase, and ATP in which light production is proportional to ATP present. Of several technique variables investigated, temperature of ATP extraction from cells was found to be highly critical; extraction solutions a few degrees below boiling yield much less ATP. The finalized procedure is highly sensitive and reliable; relative standard deviations for activated sludge replicates are commonly less than 2% and recovery of added ATP from activated sludge are relatively constant 100%. ATP levels in activated sludge are relatively constant under endogenous conditions, indicating the potential of ATP as an estimate of viable biomass and respond rapidly to induced changes in metabolic activity. The advantages of an activity parameter over historically used biomass parameters for activated sludge operation control are manifold; ATP assay holds promise as a sensitive tool for future research on sludge activity and process control. (Hancuff-Texas)
W71-01849

GOOD MANAGEMENT INCLUDES EFFECTIVE SAFETY PROGRAMS,
Water Pollution Control Federation, Washington, D.C.
Bob G. Rogers.
Journal Water Pollution Control Federation, Vol 42, No 9, p 1614-1620, September 1970. 1 fig, 2 tab, 2 ref.

Descriptors: *Management, *Safety, *Administration, Cost, Insurance, Operations, Waste water treatment, Sewage treatment, Programs.
Identifiers: Injuries, Records.

Through surveys of waste water collection and treatment systems in the United States the Water Pollution Control Federation has determined that the safety record in the waste water pollution control field is worse than that in any of 41 industries reporting regularly to the National Safety Council. This poor record is costing the field more than $30,000,000 each year in added insurance cost, lost time and reduced productivity. Personnel morale and public image are among other factors sustaining damage but to which no monetary value may be assigned. The Federation has developed safety promotional materials aimed at first convincing management of the need for and value of safety programs and going on to furnish specific aids and training materials for safety. (Hancuff-Texas)
W71-01850

CHARGES FOR TREATING INDUSTRIAL WASTE WATER IN MUNICIPAL PLANTS,
World Health Organization; and John Hopkins Univ., Baltimore, Md. Dept. of Sanitary Engineering.
Yves Maystre, and John C. Geyer.
Journal Water Pollution Control Federation, Vol 42, No 7, p 1277-1291, July 1970. 2 fig, 6 tab, 3 ref.

Descriptors: *Industrial wastes, *Sewage treatment, *Cost, Waste water treatment, Mathematical models, Biochemical oxygen demand, Waste disposal.
Identifiers: *Charges, Suspended solids, Computations, Expenses.

A survey of current practices of charging for discharge of industrial waste into municipal sewers in the U.S.A. revealed that the surcharges may be expressed in a single form that takes into account the biochemical oxygen demand and suspended solids of the waste. A suggested two step procedure may be used to calculate the charges for domestic waste, waste from normal industries and the surcharges for industries with unusually strong wastes. The suggested approach provides for equitable charges which avoiding the expense of individual sampling of all industrial effluents. A set of sample calculations is given for a city treating 10,000 million gallons per year with an average BOD of 368 mg/l and 338 mg/l suspended solids. The total industrial waste water amounts to 3,850 million gallons per year. Four industries have been selected as having very high loads. The individual surcharge factors are calculated and applied to these four industries according to the nature of their flow and strength. (Hancuff-Texas)
W71-01851

INFILTRATION IN SEPARATE SANITARY SEWERS,
Riddle Engineering, Inc., Kansas City, Mo.
W. G. Riddle.
Journal Water Pollution Control Federation, Vol 42, No 9, p 1676-1683, September 1970. 4 fig.

Descriptors: *Infiltration, *Sewers, Costs, Runoff, Maintainance, Repairing, Storm runoff, Construction, Waste Water Treatment.
Identifiers: *Detection methods.

Results of a two year survey in the matter of eliminating infiltration and stormwater in sewage systems in Western Missouri and Eastern Kansas is reported. A questionaire was mailed to approximately 50 pollution abatement facility managers and 49 replied. Location of storm water inlets is made by a comprehensive, economical smoke testing program which allows visual identification of contributing roof leaders, street inlets, broken pipes, ruptured manholes and yard, driveway or area-way drains. Infiltration and its correction is a separate problem. Visual observation is practicable only by television or photography; however, a recent development which is receiving considerable and favorable attention is low pressure air testing. Once the exact or general location and character of infiltration has been determined the effects may be corrected in one of the following ways: (1) excavation and replacement or repair, (2) localized pressure grouting from within, (3) generalized low pressure sealing from within, (4) lining to a reduced diameter, (5) pressure grouting from without. Cost for the various methods are presented. The supplier of sealing chemical claims sealing efficiencies range from 70 to 95%. Costs of treating and 8 inch sewer ranged from 80 cents to a $1.00 a foot plus the cost of chemical. It is concluded that there is no satisfactory repair or maintainance substitute for high quality initial construction. (Hancuff-Texas)
W71-01852

FEASIBILITY OF A SPORT FISHERY IN TERTIARY TREATED WASTE WATER,
Arizona Cooperative Fishery Unit, Tucson.
Robert J. Hallock, and Charles D. Ziegell.
Journal Water Pollution Control Federation, Vol 42, No 9, p 1656-1665, September 1970. 3 fig, 4 tab, 20 ref.

Descriptors: *Tertiary treatment, *Fisheries, *Waste water treatment, *Feasibility studies, Fish farming, Filtration, Fish, Biomass, Food chains, Photosynthesis, Phosphours, Trout, Catfishes.

Specific objectives of this study were to determine a suitable fish species, their survival, growth and yield in tertiary treated waste waters and to evaluate food chain relationships. Physical and chemical parameters such as temperature, DO, pH, and orthophosphate were also considered. The tertiary treatment consisted of spreading activated sludge effluent over sand and gravel filters. Horizontal filtration distances varied from 50 to 100 feet while vertical filtration distances varied from 3 to 20 feet. Fish tested were channel catfish, rainbow trout, and Malacca tilapia hybrids. The final fish survival percentages differ greatly from pond to pond. In two of the three initial channel catfish experiments and in all the tilapia experiments survival exceeded 70%. Survival did not exceed 1% in any of 5 trout experiments. An important cause of death was the low oxygen concentration and high ammonia concentrations. Oxygen was measured as low as 2.7 mg/l and ammonia was as high as 11 mg/l. The large variation in oxygen concentrations seems to be a result of respiration by dense phytoplankton blooms which were stimulated by high inflow orthophosphate concentrations, 14 mg/l. The highest combined yield of locally acceptably channel catfish and talipia from one pond was 697 lbs per acre, yield much greater than that from natural waters. Chironimus larva, the predominant food organism, comprised 90% of the estimated annual benthos production of 12,680 lbs. per year per acre. (Hancuff-Texas)
W71-01853

A NEW APPROACH TO CONTROLING BIOLOGICAL PROCESSES,
Southwest Research Inst., San Antonio, Tex.
Leland L. Hiser.
Environmental Science and Technology, Vol 4, No 8, p 648-651, August 1970. 3 fig, 1 tab, 4 ref.

Descriptors: *Biological treatment, *Control, *Carbon, Waste water treatment, Sewage treatment, Biochemical oxygen demand, Energy.
Identifiers: Total oxygen demand, Volatile solids.

Some criticism is given of the current use of the BOD test as a control paramente for waste water treatment systems. It is felt that separate parameters to describe 3 distinct variables--food, energy, and culture--would lead to a simpler and more

widely understood concept of the biological system. Since carbon is a basic food supply of living matter, it is logical that it should be a primary parameter for describing both of the food supply and the culture content from microbiological systems. A simplified carbon nomenclature is used to describe the many forms in which carbon can be present. In the liquid phase it includes dissolved organic carbon and dissolved inorganic carbon; the solid phase includes suspended organic carbon and suspended inorganic carbon, the gas phase includes gas organic carbon and gas inorganic carbon. It is suggested that the energy requirement can be determined as the total change in oxygen demand of the system coincident with the conversion of carbon. It is stated that this approach will assistin the breakdown of biological treatment process into a series of describable unit operations which are amenable to material balances and more precise descriptions of unit rate. Two advantages of this type of analysis are: (1) analytical time is reduced from days to minutes and (2) it is possible to make both materials and energy balances. (Hancuff-Texas)
W71-01854

KINETICS OF THE MICROBIAL DECOMPOSITION OF THE HERBICIDES IPC AND CIPC,
Oregon State Univ., Corvallis. Dept. of Agricultural Chemistry.
Paul G. Moe.
Environmental Science and Technology, Vol 4, No 5, p 429-431, May 1970. 3 tab, 6 ref.

Descriptors: *Degradation (Decomposition), *Kinetics, *Herbicides, Microorganisms, Bacteria, Growth rated, Energy, Hydroloysis, Organic compounds, Soils, Waste water treatment.
Identifiers: Reactions.

Incubation instruments using IPC and CIPC as primary carbon sources for the growth of Pseudomonas striata were conducted at 20 and 30C. Reaction rate constants for the initial hydrolysis reactions were calculated from an equation based on both the herbicide concentration and the bacterial mass present in the system. The IPC concentrations were 50, 100 and 200 ppm and because of the water solubility of CIPC concentrations of 25, 50 and 100 ppm were employed. Good bacterial growth was obtained in all the inoculated flasks. Lag periods varied considerably with initial herbicide concentration particularly with IPC, but averaged about 40 hours for IPC and about 130 hours with CIPC. The length of the logarithmic growth phase generally increased with the initial herbicide concentration ranging from 16 to 40 hours. The ratio of bacterial mass formed for the unit of herbicide decomposed, essentially a measurement of metabolic efficiency, varied from 6.8 to 9.2% with IPC and from 3.0 to 5.0% with CIPC. Activation energy required for the hydrolysis of IPC was about 4 K cal/mole whereas for the hydrolysis of CIPC it was 2 K cal/mole. (Hancuff-Texas)
W71-01855

DIGESTION FUNDAMENTALS APPLIED TO DIGESTER RECOVERY--TWO CASE STUDIES,
Iowa Univ., Iowa City. Dept. of Civil Engineering.
Richard Dague, Robert L. Hopkins, and Robert W. Tonn.
Journal Water Pollution Control Federation, Vol 42, No 9, p 1666-1675, September 1970. 2 fig, 2 tab, 16 ref.

Descriptors: *Control, *Digestion, *Anaerobic digestion, Hydrogen ion concentration, Alkalinity, Ammonia, Industrial wastes, Waste water treatment, Methane.
Identifiers: *Case studies, *Upset recovery, Volatile acids, Gas production.

The anaerobic digestion systems of concern are located at Clinton and Keokuk, Iowa. Both systems received significant solids from grain and processing industries. Initial conditions at Clinton were pH 5.5 to 6.0, volatile acids 4000 to 5000 mg/l, alkalinity 2000 mg/l, gas production 0. At Keokuk initial conditions were pH 6.0 to 6.3, volatile acids, 8000 mg/l, alkalinity 3,000 mg/l, gas production 0. Alkali was added to raise the pH to about 6.8. The recovery at Clinton showed significant gains only when the pH was greater than 6.5. Part way through the recovery period at Keokuk the addition of lime was halted in favor of aqueous ammonia. The use of ammonia to neutralize 10,000 mg/l of volatile acids resulted in ammonia toxicity and cessation of gas production. At this time the concentration of ammonia in the system was 2,500 mg/l as NH3. There is no apparent relationship between the concentration of volatile acids in the digester and the ranges of gas production. A definite relationship between pH and the rate of gas production is apparent; the minimum pH indicated is 6.5. (Hancuff-Texas)
W71-01856

PETROLEUM PROCESSING WASTES (LITERATURE REVIEW),
Maine Univ., Orono.
Millard W. Hall.
Journal Water Pollution Control Federation, Vol 42, No 6, p 1205-1211, June 1970. 31 ref.

Descriptors: *Industrial wastes, *Waste water treatment, *Oil costs, Design, Waste disposal, Biological treatment.
Identifiers: *Petroleum wastes, Refineries.

Recent literature in the petroleum processing wastes area is summarized. A large scale joint industry waste disposal facility on the Houston ship channel is discussed. The ten thousand ton per month capacity facility will handle liquid solids and semi-solid wastes. In-plant measures of reducing the waste water discharge problems in the petroleum refining industry is presented and a variety of examples given. A system for the thermal decomposition of fluidized industrial wastes was developed. It operates at approximately 2,000F and destroys most types of liquid and semi-liquid wastes, virtually elimating both water and air pollution. Several methods of treating oils are discussed and include sedimentation, biological processes, and sand filtration. The development of waste water management programs is described and an example is sited in which the effluent stream from a treatment facility is utilized in ponds which have developed into a bird sanctuary and apparently become an asset to the community. Some data is presented for the biological treatment of combined petrochemical and municipal waste water. An environmental management program undertaken in the planning and development of a major new petrochemical facility is presented. Water conservation waste treatment methods are discussed for a 125,000 bbl per day refinery. Deep-well disposal techniques for the disposal of both liquid and liquid solids wastes streams are presented. Several sources concerned with the biologic oxidation of petroleum wastes are summarized. (Hancuff-Texas)
W71-01857

DEVELOPMENT OF A FLUIDIZED-BED TECHNIQUE FOR THE REGENERATION OF POWDERED ACTIVATED CARBON,
Battelle Memorial Inst., Columbus, Ohio. Columbus Labs.
A. K. Reed, T. L. Tewksbury, and G. R. Smithson, Jr.
Environmental Science and Technology, Vol 4, No 5, p 432-437, May 1970. 4 fig, 5 tab.

Descriptors: *Activated carbon, Adsorption, *Sewage treatment, Waste water treatment, Tertiary, Treatment efficiency, Performance.
Identifiers: *Fluidized-bed, *Regeneration, Variables, Losses, Pulsing.

The study on the regeneration of spent powdered carbon was directed toward the development of a fluidized-bed regeneration technique. Two fluidized-bed systems were considered during the course of the investigation. A system in which the dried spent carbon was regenerated during its passes through a fluidized-bed of an inert material; and a pulsating fluidized bed system in which the finely divided regenerated carbon served as the bed material. A major portion of the experimental study made upon the fluidized inert bed system consisted of an evaluation of the fluidized technique. The major variables examined and ranges studied during the program were as follows: temperature - 500 to 1500F, composition of the fluidizing gas-selected mixtures of nitrogen, oxygen, carbon dioxide and water, bed weight - 0 to 6,720 grams, bed depth - 0 to 11.5 inches, moisture content of feed- 0.5 to 50% water. Data obtained during these experiments are tabulated and compared. In the study of the pulsed fluidized-bed system the pulsations were obtained by simply interrupting the flow of fluidizing gas with frequencies on the order of 400 to 500 pulses per minute. With the fluidized inert bed system regenerated carbon products were obtained which has absorptive capacities of 100% when compared with virgin activated carbon. The weight recoveries were as high as 88%. Similar regeneration also was obtained with the pulse fluidized-bed system. (Hancuff-Texas)
W71-01858

A MASTER PLAN REPORT FOR THE ATLANTIC COUNTY NEW JERSEY PLANNING BOARD, WATER AND SEWER STUDIES.
Atlantic County Planning Board, Atlantic City, N.J.

Available from NTIS as PB-189 718, $3.00 in paper copy, $0.95 in microfiche. Atlantic County Planning Board, October 1969. 60 p folder, 13 tab. HUD Project N.J.-99.
Identifiers: *Urban planning, *New Jersey, *Water supplies, Urban planning, *Sewage, Sanitary engineering, Water pollution, Fire safety, Water resources, Surface waters, Waste water treatment, *Atlantic County (New Jersey), *Area planning and development.

Existing sewerage and water facilities are dealt with and some proposals are made for a future Countywide sewer system. Planning for future water supply is discussed along with the nature and types of pollution and the types of surface water according to the uses for which it is suited. Existing sewerage facilities are indicated in the three regions into which the County is divided. Three alternative comprehensive County sewerage plans are outlined. Existing water supply and fire protection in Atlantic County is described along with planning for future water supply. Four large maps are included showing: surface water quality, existing waste water treatment facilities alternative sewerage facility plans, and existing water supply facilities.
W71-01875

METABOLIC STORAGE OF PHOSPHORUS IN THE ACTIVATED SLUDGE FLOC,
Marquette Univ., Milwaukee, Wisc. Dept. of Civil Engineering.
S. K. Malhotra.
Available from NTIS as PB-195 980, $3.00 in paper copy, $0.95 in microfiche. Wisconsin Univ. Water Resources, Technical Completion Report, July 1970. 80 p, 8 fig, 72 ref. OWRR Project A-015-WIS (1).

Descriptors: *Phosphorus, *Activated sludge, *Calcium, *Iron, *Waste water treatment, Sewage treatment, Flocculation.
Identifiers: *Cations, *Synthetic feed, *Secondary waste treatment, Mixed liquor.

Two laboratory batch aeration units were operated under similar conditions using synthetic feed with and without phosphates. With synthetic feed, the normal activated sludge flocs after being washed off of their cations exhibited a phosphorus storage between 2.5% and 2.9% based on the mixed liquor

volatile suspended solids (MLVSS). The storage of phosphorus was found to be independent of MLSS and organic load levels. The phosphorus starved activated sludge flocs also exhibited identical phosphorus storages. This agrees with the findings of Menar and Jankins (1968) that the biologically incorporated phosphorus in the activated sludge floc varies between 2% and 3% based on the volatile mass of activated sludge. After test runs exhibited practically the same percent phorphorus in the volatile mass, the units were subdivided and fed with the same standard synthetic feed except that different amounts of cations (Ca.... and Fe.....) were added to it to obtain the increase in the percent phosphorus in the cell mass due to the cations in the feed. The percent phosphorus incorporated in the volatile mass was increased from an average of 2.89% to 3.44% with 40 mg/l of Ca.... and from 2.89% to 4.27% with 120 mg/l of Ca.... in the feed. The corresponsing calcium content of the sludge was 3.1% and 5.1% on the volatile mass basis. Similarly 15 mg/l and 30 mg/l of Fe..... in the feed enhanced the percent phosphorus in the volatile mass. (Malhotra-Wisconsin)
W71-01896

WATER QUALITY CONTROL WITH SYNTHETIC POLYMERIC FLOCCULANTS,
Connecticut Univ., Storrs. Inst. of Water Resources.
J. K. Dixon.
Available from NTIS as PB-195 983, $3.00 in paper copy, $0.95 in microfiche. Technical Completion Report, November 1970. 4 p. OWRR Project A-016-CONN (1).

Descriptors: *Flocculation, Filtration, Electrophoresis, Settling, *Algae, *Silica, *Bacteria, Water pollution control, Waste water treatment.
Identifiers: Polyacrylamide, Polyethylenimine.

Studies have been made of the flocculation of silice, algae and bacteria by means of low concentrations of synthetic polymers. The effects of polymer molecular weight and structure have been emphasized, using the silica, and pure cultures of green algae and E. coli under a variety of conditions of pH and colloid concentration. Filtration rate, light transmission and electrophoretic mobility have been employed to measure degree of flocculation. Non-ionic and anionic polymers did not produce flocculation, but cationic polyethyleneimines were effective at concentrations of 0.1 to 100 ppm, the optimum being dependent on pH, colloid concentration and polymer molecular weights above about 2000. Algae required some 30 to 500 times higher solution concentration of polymer than did the bacteria and silica, respectively. Two types of polyethyleneimine polymer tagged with radioactive C14 were prepared which flocculated the three kinds of colloids in the same way as untagged polymers. In the region where flocculation was optimum the concentrations of polymer adsorbed on the colloid surfaces stood in roughly the ratio1:10:200 for silica, E. coli and algae, respectively. Poor flocculation efficiency was not to be associated with low adsorption, but to specific polymer-surface interactions which reduced the efficiency of the adsorbed polymer. The results have been shown to conform with current theories of flocculation of other colloids. They should assist in attaining better water quality control by the use of the synthetic polymers in numerous practical operations. (Dixon-Conn)
W71-01899

FLOCCULATION OF COLLOIDS WITH POLYELECTROLYTES IN AQUEOUS SALT SOLUTIONS,
Rhode Island Univ. Kingston. Dept. of Civil Engineering.
Donald L. Sussman.
Available from NTIS as PB-195 977, $3.00 in paper copy, $0.95 in microfiche. Technical Completion Report, Rhode Island Water Resources Center, October 1970. 14 p. OWRR Project A-024-RI (1).

Descriptors: *Flocculation, Coagulation, *Polyelectrolytes, *Colloids, *Corn starch, *Tannic acid, *Calcium ion, Waste water treatment.
Identifiers: Sodium polystyrene sulfonate, *Chloride, *Refiltration rate, *Turbidity, *Flocs.

The purpose of this research was to observe the behavior of organic colloids in the presence of polymeric flocculants and the ionic salts NaCl, NaClO4)2. The study was defined in terms of the flocculation kinetics and the absolute turbidity. In the flocculations of corn starch, and tannic acid the presence of the calcium ion greatly accelerated the rate of flocculation, and chloride ion had a slight desruptive effect on floc formation. The flocculation studies were confirmed by refiltration rate experiments where the floc sizes were determined. The flocs with calcium ion were the largest and those with chloride the smallest. (Sussman-Rhode Island)
W71-01901

ACTIVATED CARBON RECLAIMS WATER FOR CARPET MILL,
Stephen-Leedon Carpet Co.
William H. Phipps.
Water and Wastes Engineering/Industrial, Vol 7, No 5, p C22-C23, May 1970. 2 fig.

Descriptors: *Activated carbon, *Reuse, *Waste water treatment, Color, Chemicals, Organic matter, Dewatering, Water temperature, Adsorption, *Pennsylvania.
Identifiers: *Carpet mill waste water, Dyes.

To meet pollution control laws, the Hollytex Carpet Mills installed waste water reclamation system in a new plant. The waste water from the dyeing, rinsing, vacuum dewatering process contains lint, dyes, chemicals, organic matter, color, and turbidity. At production capacity, 500,000 gpd is discharged. The reclamation system has an adsorber containing 50,000 lbs. of Filtrasorb (a Calgon Corp. product) granular activated carbon, to achieve 80% recovery of waste water. The activated carbon is a high density, high porosity carbon. Pole structure is carefully controlled to provide effective adsorption of both high and low molecular weight organic impurities. Mesh is 12 x 40 U.S. Std. Prior to the adsorption unit, the waste water passes through two stainless steel lint removal conveyors. The carbon is contained in a plastic-lined, mild steel adsorber, 27 x 9 ft, 9 in. in diameter. The waste water flows upward through the moving bed adsorber. Spent carbon is conveyed in a water slurry to a holding tank from where it is educted to a combination dewatering furnace feed screw. Carbon is reactivated in a multiple-hearth, gas-fired furnace equipped with a wet scrubber for removal of particulates from exhaust gases. Reactivated carbon is discharged from the furnace to a quench tank and then to a pressure vessel from where it is hydraulically transported to a feed tank atop the adsorber. Losses are expected to be about 5%. Purified water flows to a cooling tower where it is cooled to 90LF. from an incoming temperature of 180LF. (Selby-Texas)
W71-01966

THERMOPHILIC ACTIVATED SLUDGE PROCESS,
Mississippi State Univ., State College.
Adnan Shindala, and James E. Parker.
Water and Wastes Engineering, Vol 7, No 3, p 47-49, March 1970. 2 tab, 3 fig, 8 ref.

Descriptors: *Activated sludge, *Thermophilic bacteria, Biochemical oxygen demand, Organic loading, Waste water treatment, Sewage treatment.
Identifiers: *Raw sewage, Solids return.

The ability of thermophilic aerobic microorganisms to provide adequate treatment of a waste by activated sludge process under varying organic loading conditions is discussed. Laboratory data show that at 55 degrees C, with no solids return, the overall BOD reduction was 94% under varying organic loading conditions. Decreasing the detention time has no apparent effect on the BOD reduction efficiency. With a return solids ratio of 1:1, the average BOD reduction efficiency was 85%. A variation of mixed liquor suspended solids concentration from 200 to 650 mg/L had no apparent effect on the removal efficiency. (Selby-Texas)
W71-01967

COLDWATER CREEK WASTE WATER TREATMENT PLANT,
Joseph W. Larson.
Water and Wastes Engineering, Vol 7, No 4, p 44-48, April 1970. 3 tab, 3 fig.

Descriptors: *Waste water treatment, *Treatment facilities, Design, Sewage treatment, Missouri, Activated sludge.
Identifiers: *St. Louis (Mo).

Because of the rapid growth of the Metropolitan St. Louis area and because the Coldwater Creek is substantially dry, the area adjacent to the Coldwater Creek waste water treatment plant and downstream requires the discharge of a high quality effluent. For these reasons, the plant is of the activated sludge-type that provides for the chlorination of the plant effluent and, if necessary, for odor control, the plant influent and digester supernatant as well. Treatment consists of grit removal followed by comminution, primary settling, aeration, final settling, and chlorination before the effluent is discharged into Coldwater Creek. Primary and waste-activated sludge, sometimes thickened, is pumped into digesters. The digested sludge is disposed of in open sludge storage basins. When necessary, digester supernatant can be returned to the raw sewage flow or to the aeration basins in order to increase the solids loading. In addition to the pump and blower building, major structures include the grit basins and comminutors, primary settling tanks, aeration tanks and control building, final clarifiers, sludge thickener, digesters, chlorination facilities, and shope and garage areas. The 40-acre treatment plant complex is situated on a 78-acre tract north of Coldwater Creek and 11 miles north of the center of St. Louis. (Selby-Texas)
W71-01968

SINGLE-STAGE LIME CLARIFICATION OF SECONDARY EFFLUENT,
Robert A. Taft Water Research Center, Cincinnati, Ohio. Advanced Waste Treatment Research Lab.
E. L. Berg, C. A. Brunner, and R. T. Williams.
Water and Wastes Engineering, Vol 7, No 3, p 42-46. 7 fig, 1 tab, 6 ref.

Descriptors: *Effluents, *Filters, Turbidity, Lime, Water reuse, Reclaimed water, Waste water treatment, Tertiary treatment.
Identifiers: *Clarification, Anthracite filter, Sand filter, Characteristics.

This study was undertaken to produce suitable clarified water from secondary effluent for an advanced waste treatment system which includes granular activated carbon treatment and electrodialysis. The clarifier was operated at various pH values to ascertain also the effects upon those constituents normally present in secondary effluent. Results showed that a lime clarification system can be effective and economical tool for the clarification of relatively hard waste water. Water of high clarity, however, is obtainable only during optimal operation of the biological oxidation process. The system also removed large amounts of phosphate, a major nutrient that supports algae life. The economics of the system are comparable with other forms of clarification. (Selby-Texas)
W71-01969

ADVANCED WASTE TREATMENT IN NASSAU COUNTY, NEW YORK, WATER PROVIDED FOR INJECTION INTO GROUNDWATER AQUIFERS,
Burns and Roe, Inc., Oradell, N.J.
John L. Rose.

Water and Waste Engineering, Vol 7, No 2, p 38-39, February 1970. 2 fig, 3 tab.

Descriptors: *Waste water treatment, *Tertiary treatment, *Water reuse, Aquifers, Activated sludge, Coagulants, Injection wells, Observation wells, Costs, New York.
Identifiers: *New York, *Hydraulic barrier, Backwash, Nassau County (N.Y.).

To meet a threat of salt water intruding into its aquifers, Nassau County, New York, considered a proposal which would allow an increase of the permissible withdrawals, to create a hydraulic barrier in the aquifer, which would prevent both the natural outflow, now lost to the sea, and the intrusion of salt water. The barrier would be formed by injecting treated waste water through a series of recharge wells. For evaluation purposes, a 400 gpm demonstration plant was constructed. The plant provides tertiary treatment for the effluent of the conventional activated sludge plant. The product water is pumped about one-half mile to a test injection site. The tertiary treatment plant is a conventional water treatment plant modified to utilize secondary effluent as a water source. Effluent is pumped into a clarifier to which alum and coagulant aids are added. The supernatant flows by gravity to two mixed media filters operated in parallel. Final backwash is semi-automatic and includes air scour, surface wash, and high-and low-rate backwashing. Filter effluent is pumped through four granular activated carbon adsorbers. The renovated water is disinfected with chlorine before being pumped to the injection site. The injection facilities consist of a storage tank, a degasifier for removal of dissolved gases, injection and redevelopment pumps, an injection well, and 12 observation wells. The injection well is 36 inches in diameter by 500 feet deep and contains an observation well and geophysical probes. Costs are tabulated. Operation of the tertiary treatment plant and injection system since January 1968, confirms the concept of recharging waste waters into the aquifer. The well has been redeveloped after each series of injection tests with negligible loss of capacity. The treatment plant has consistently produced water meeting the injection quality criteria. (Selby-Texas)
W71-01970

DEEP-BED FILTER SYSTEM FOR MILL SCALE REMOVAL,
Dravo Corp., Pittsburgh, Pa. Dept. of Water and Waste Treatment.
Donald F. Heaney.
Water and Wastes Engineering/Industrial, Vol 7, No 3, p B6-B7, March 1970. 3 fig, 1 tab.

Descriptors: *Filtration, *Industrial wastes, Scaling scour, Lake Michigan, Coagulation, Waste water treatment.
Identifiers: *Deep-bed filters, Backwashing.

The Youngstown Sheet and Tube Company added a new 84-inch hot strip mill to its Indiana harbor works in the hope of minimizing the discharge of mill scale and other pollutants into Lake Michigan. The 60,000 gpm treatment facility has 42 deep-bed filters providing 8,900 sq. ft. of filter area. Backwash air is used at a rate of 2,600 cfm when washing two filter tanks. Valves controlling backwash water flow are operated from their own instrument air system. One section of 7 dual filters is backwashed on each shift, with each dual unit requiring 30 minutes for complete washing. The pressure build-up varies between 15 and 25 feet water gauge. If the pressure build-up exceeds a preset figure of approximately 30 feet water gauge, the filters go automatically into backwash in turn. This continues until all filter units have been cleaned. The backwash water is returned to the influent end of the scale pits. Operating experience has proved that addition of a coagulating polymer is not always necessary. The scouring air required in backwash is distributed by a lateral pipe system and is controlled by the 'M' block units. Individual domes in the blocks ensure uniform distribution through the sand during backwash. Backwash water is taken from the filtrate header. The filtrate is emptied into the lake through a continuous monitoring system. Not only did the deep-bed filter system offer substantial savings in space and economics of operation, but results for 18 months of operation have been highly satisfactory. The water coming from the two-scale basins averages 20 to 70 mg/L oil and 70 to 110 mg/L solids. The effluent from the filter averages 3 to 5 mg/L oil and 3 to 5 mg/L solids-about equivalent to the quality of the water taken from the lake. (Selby-Texas)
W71-01971

A TREATMENT PROCESS FOR STRONG CANNERY WASTES,
Oklahoma Univ., Norman. Coll. of Engineering.
George W. Reid, and Leale Streebin.
Water and Wastes Engineering/Industrial Vol 7, No 3, p B1-B5, March 1970. 5 fig, 4 tab, 8 ref.

Descriptors: *Canneries, *Industrial wastes, Design, Treatment facilities, Biological oxygen demand, Waste water treatment.
Identifiers: *Potato wastes.

A small community sewage treatment plant could not accept the high-volume, strong organic wastes of a cannery. After a study was completed, it was recommended that the combined raw waste stream be separated from the municipal waste and routed through a separate treatment system. This system will consist of screens to remove large pieces of waste product, which will be trucked to an existing landfill. The screened waste will flow first to a high-rate minimal-solids aeration basin, designed to remove 50% of the soluble BOD, and then to two low-rate, extended aeration basins for polishing, followed by final clarification. Nutrients will be fed prior to the minimal solids unit to balance the waste for optimal organic removals. Sludge return to the front of all aeration tanks will be provided to maintain a recirculation ratio of approximately 1 to 1. (Selby-Texas)
W71-01972

TREATMENT PLANT DESIGNED FOR FROZEN MEAT WASTES,
Bissell, Merrill and Associates, Williamsville, N.Y.
William H. Merrill, Jr.
Water and Wastes Engineering Vol 7, No 5, p C5, May 1970. 1 fig.

Descriptors: *Design, *Industrial wastes, Lake Erie, Biochemical oxygen demand, Waste water treatment, Aerobic conditions, Aerobic treatment, Flocculation, New York.
Identifiers: *Food processing wastes, Packaging plants, Buffalo (New York).

A packaged frozen meat products plant was established outside Buffalo, New York, where there were no sewers and none planned. Design flows of the plant were 100,000 gpd. In setting up a waste water treatment facility, data from another plant was considered. The pH intensity level of the wastes indicated a biological treatment would be favorable and a nutrionally balanced system would result. However, the high ether solubel content would seriously affect a biological system by imparing the oxygen transfer efficiency of applied air. Therefore a system for removing the ether solubles would have to precede the biological system. This would also affect some BOD removal. Initial treatment of the waters is in an air flotation cell, where grease and fats along with most of the suspended solids are removed. After completion of the flotation process and before entering the aeration unit, the subnatant is mixed with the domestic waste from the inplant population. The combined waste entering the aeration tank is aerated and detained for about 24 hours. During this time, air is continuously mixed with the waste water by means of a surface aerator. From the aeration tank the water is clarified for 4.5 hours. Water leaving the clarifier is chlorinated and discharged through a measurement flume into Lake Erie. The lengthy outfall line acts as a chlorine contact tank. The overall BOD removal efficiency averages 85 to 90% at present and is expected to increase as the plant's experience grows. (Selby-Texas)
W71-01973

PLANNING OF MUNICIPAL WASTE WATER RENOVATION PROJECTS,
Bechtel Corp., San Francisco, Calif. Scientific Development Dept.
J. W. Porter.
Journal of the American Water Works Association, Vol 62, p 543-548, September 1970. 2 tab, 3 fig, 6 ref.

Descriptors: *Waste water treatment, *Municipal water, Planning, Attitudes, Economics, Water reuse, Reclaimed water.
Identifiers: *Public acceptance, Waste water renovation.

The planning of municipal waste water renovation projects will be increasingly important in the water resources field. This is primarily true because of the benefits of water supply and pollution control of such projects. In order to systematically develop such projects it will be necessary to consider economic, technical, institutional, and public acceptance aspects. The basic economic considerations revolve around water pollution control/water supply functions of a water renovation facility, and these same functions in separate, more 'conventional' facilities. The technical considerations are, to a large extent, a function of the planned use of the product water and has aspects of process selection and water quality criteria, reliability, public health considerations, and pilot/demonstration work. A basic operational change occurs when the 'renovation/reuse' concept is substituted for the 'treatment/discharge' concept. The public acceptance of renovated waste water must be carefully considered; and suggested guidelines in planning for public acceptance are: (1) sampling of attitudes, (2) informing local press and civic organizations, (3) keeping public health agencies fully informed, (4) potential users such as industry should be brought into planning early, and (5) water conservation, pollution control and possible economic benefits should be stressed in public announcements. The relative importance of all these aspects of planning for waste water renovation projects will depend on such items as the type of water use envisioned, the project location and the entities involved. (Selby-Texas)
W71-01974

A STUDY OF MEAT PACKING AND RENDERING WASTES,
Wayne State Univ., Detroit, Mich.
Henry A. Dirasian.
Water and Wastes Engineering/Industrial Vol 7, No 5, p C16-C20. 2 fig, 2 tab, 2 ref.

Descriptors: *Industrial wastes, *Sewage treatment, Sewage disposal, Waste water treatment, Michigan.
Identifiers: *Food processing, Wastes, Grease removal, Detroit (Michigan).

A meat packing and rendering firm was informed by the City of Detroit that its effluent did not fall within the city sewer use ordinance as it related to grease content. A study was made to suggest needed action to reduce the amount of grease entering the sewer. The first part of the study indicated the substantial amount of pretreatment of waste water was required if the regulations were to be met. A second step of the study was the construction of a laboratory scale pressure flotation unit. The unit consists of a pressurized chamber in which either plain water of plant effluent is put under pressure and released to the flotation column in which the waste is held. The results of the limited study showed that: pressure flotation, assisted by an acceptable flotation aid (alum in this case), would remove the greater portion of the grease produced in a meat packing and rendering plant; in this study a recirculation ratio of 4 to 1 was maintained and a flotation period of 20 minutes was standard-this 20

minute retention period is somewhat less than the 30 to 60 minute usually provided and will allow the laboratory studies to be extrapolated to a field unit; and the required alum concentration varies lineraly with the amount of SS in the influent in the ranges explored in this study. (Selby-Texas)
W71-01975

NOVEL BIOLOGICAL TREATMENT PROCESS UTILIZED UNIQUE REDWOOD MEDIA,
Cornell, Howland, Hayes and Merryfield, Corvallis, Oreg.
Frank D. Schaunberg, and Sidney Lasswell.
Water and Wastes Engineering Vol 7, No 8, p 34-37, August 1970. 3 fig, 1 tab.

Descriptors: *Activated sludge, *Biological treatment, *Trickling filters, Slime, Void ratio, Biological oxygen demand, Waste water treatment, Oregon.
Identifiers: *Redwood, Support media.

A pilot plant investigation was undertaken during 1969 to evaluate the potential of redwood slats as a biological support media. The process, called Activated Biofilter, is a novel biological treatment designed to combine the desirable features of the fundamental trickling filter and activated sludge processes by circulating a mixed liquor of secondary sludge and filter underflow through a redwood slat biological support media. This lightweight media (10.3 lb/cu ft.) is relatively inexpensive, and appears very durable. The rough-sawn texture of redwood slats facilitates the retention of biological slime. Redwood media has about double the void percentage and void space to surface area ratio found for a comparable volume of 4 inch diameter rock media. The specific surface of redwood media (14 sq ft/cu ft) is slightly greater than that of 4 in. rock. The investigation took place at the Corvallis, Oregon, municipal sewage treatment plant. Findings of the study concluded that the Activated Biofilter process can be expected to produce a high-quality effluent in terms of BOD at loadings of up to 200 lb. BOD per day per 1000 cu ft and with MLSS of 3000 to 6000 mg/L. Shock organic loads and wastes containing significant quantities of carbohydrates can apparently be treated by the ABF process without a severe reduction in treatment efficiency. The activated biofilter system appears to combine the most desired characteristics of the trickling filter and activated sludge processes. Future studies will help determine optimum conditions of media depth, underflow recycle ratio and hydraulic application rates. (Selby-Texas)
W71-01976

CANNING (LITERATURE REVIEW),
G. A. Richter, and M. R. Soderquist.
Journal Water Pollution Control Federation, Vol 42, No 6, p 1165-1171, June 1970. 41 ref.

Descriptors: *Canneries, *Aerobic treatment, *Anaerobic digestion, *Industrial waste, *Waste water treatment, *Organic waste, Activated sludge, Trickling filters, Irrigation systems, Neutralization, Adsorption, Industrial wastes.
Identifiers: *Canning waste treatment, Screening, Food processing.

Both activated sludge process and anaerobic digestion using an anaerobic filter were discussed. Mechanical potato peelers, protein recovery and a dry caustic peeling process are also described. Detailed characteristics of citrus waste and descriptions of various treatment methods and their application to citrus waste water treatment were the subject of several reports. Other reports discussed the results of spray irrigation of food processing waste on fields of fruits and vegetables. The process is suitable for irrigation of crops despite the fact that wastes from fruit and vegetable processing plants are quite variable in chemical composition, depending on the type of crop being processed. Research project results of air flotation, vibratory screening trickling filtration, neutralization, activated carbon adsorption, aerated lagoons, activated sludge systems and high-rate plastic media trickling filters employing forced aeration were reported for treatment of various canning waste. A discussion of several waste disposal systems was presented and several reports gave cost efficiency relationships for (a) land area requirements, (b) capital cost, and (c) operating and maintainance cost for several alternative unit processed for canning-waste treatment. (Waid-Texas)
W71-01977

LIBERTY, S.C. TEXTILE FINISHING WASTE,
South Carolina Pollution Control Authority, Columbia.
G. A. Rhame.
Water and Wastes Engineering/Industrial Vol 7, No 5, p C6, May 1970. 3 tab.

Descriptors: *Aeration, *Design, Textiles, Lagoons, BOD, Sludge disposal.
Identifiers: *Textile wastes, South Carolina.

The ability of extended aeration systems to handle alkali textile wastes has been demonstrated successfully in Liberty, S.C. Biological utilization of the starches and other carbohydrates in cotton finishing mill wastes produces ample carbon dioxide to neutralize the alkali to a satisfactory degree. The flow pattern of the extended aeration system is straight through with a sludge recirculation at 250 gpm. No sludge disposal equipment is necessary because suspended solids are low and can be handled by tank truck. Waste volume has averaged 0.5 mgd, of which 30,000 gpd is sanitary waste. BOD removal is very high. No odors have been observed from nearby houses or the small receiving creek. There has been no need to waste sludge. Sludge settling rate is high. Performance of this plant illustrates the excellent results obtainable when the designer is generous with applied housepower. It is expected that effluent BOD will remain less than 20 mg/l at the design load of 1.0 mgd. Aeration parameters, equipment inventory, and analytical data are tabulated. (Selby-Texas)
W71-01978

WASTE WATER RECLAMATION AND REUSE,
Envirotech Corp., Palo Alto, Calif.
F. P. Sebastian.
Water and Wastes Engineering Vol 7, No 7, p 46-47, July 1970. 1 fig, 1 tab, 12 ref.

Descriptors: *Waste water treatment, *Reuse, *Tertiary treatment, California, Costs.
Identifiers: *Public acceptance.

In March 1968 the South Tahoe (Calif.) Water Reclamation Plant, the first, largest and most fully integrated plant in the world today producing water of potable quality directly from sewage effluent, began operation and has since processed one billion gallons of waste water, enough drinking water quality effluent for the annual household needs of 30,000 people. The incremental cost of discharging secondary effluent is $.166 per 1000 gallons. The stated operational cost includes carbon adsorption and regeneration at $.036 per 1000 gallons. Public resistance to the use of renovated water is lessening. Use of this type of water in long distance space flights will help increase public acceptance. According to the U. S. Public Health Service, drinking water standards do not apply to direct use of reclaimed water for drinking. Research is reportedly planned to establish the needed standards for water from heavily polluted sources. The potential benefits of purified waste water are greater than the incremental costs. The value of secondary effluent is generally nil, whereas tertiary effluent ranges in value from $.09 per 1000 gallons to the cost value of fresh water, on San Francisco peninsula, of $.18 to $.376 per 1000 gallons. The virtual elimination of biostimulants and elimination of the need for ocean outfalls with unknown effects on bay and ocean ecology can be accomplished with tertiary treatment. A simplified flowsheet of South Tahoe Water Reclamation Plant is included in the article. (Selby-Texas)
W71-01979

CURRENT STATUS OF RESEARCH ON WASTE WATER RECLAMATION IN SOUTH AFRICA,
G. J. Stander, L. R. J. Van Vuuren, and G. L. Dalton.
Preprint, 1970 Conference of the Institute of Water Pollution Control (Southern African Branch), Cape Town, South Africa, March 16-20, 1970. 12 p, 3 tab, 7 fig, 8 ref.

Descriptors: Activated carbon, Coagulation, Research and development, *Waste water treatment, *Water reuse, *Reclaimed water.
Identifiers: *South Africa, Dissolved organics, Design formulation.

The efficient removal of the predominately organic impurities from waste water calls for the application of more sophisticated techniques than are normally applied in conventional water treatment. The successful operation of large-scale plants at Windhoek and Lake Tahoe have confirmed that a combination of biological, chemical and physical processes may be considered as most feasible current approach in waste water reclamation. Research conducted by the National Institute of Water Research has been focused on further refinements to some individual process units. A pilot plant was constructed in Pretoria to study the physico-chemical route for waste water reclamation. These investigations have culminated in the design and construction of a 1 million gal/day demonstration plant which will be a basis for further research on waste water reclamation in South Africa, with the main objectives of formulating design criteria for larger reclamation plants and to evaluate costs and performance data. Particular emphasis is placed on the technique developed for the application of powdered activated carbon as an integral part of the renovation process for the adsorption of dissolved organics from secondary effluents. (Selby-Texas)
W71-01980

THE APPRAISAL OF SOME SIGNIFICANT PROBLEMS IN THE REUSE OF WASTE WATER,
M. R. Henzen, and J. W. Funke.
Preprint, 1970 Conference of the Institute of Water Pollution Control (Southern African Branch), Cape Town, South Africa, March 16-20, 1970. 19 p, 10 tab, 1 fig, 9 ref.

Descriptors: *Reuse, Water requirements, Dissolved solids, Water quality, Salinity, Irrigation, Recreation demand, Cooling water, Corrosion control, *Waste water treatment.
Identifiers: *South Africa, *Effluent composition, Quality requirements.

Of the total water utilized in the Republic of South Africa, about 80% is used for irrigation and stockwatering. The remaining 20%, utilized for domestic and industrial purposes, can be tapped for reclamation. A discussion of availability of waste water for reuse is presented. The quality of waste waters vary considerable depending on origin of the waters, the extent to which it has already been reused, and the degree of dilution. Several tables demonstrate the variations in quality of waste waters, including (1) increase in mineral and organic pollution of water after one cycle of use for domestic purposes, (2) typical compositions of untreated industrial effluents, (3) composition of treated municipal sewage effluents, and (4) total dissolved solids concentration. Waste water may be reused as water supply for domestic purposes, water supply for industries, as irrigation water and for recreational purposes. The relation between water quality and requirements is also discussed. From a point of view of reuse of water, there is no reason why water of highest quality should be used for cooling purposes, since concentrations of 4,000 mg/L of dissolved solids and higher can be tolerated in evaporative recirculating systems. The use of purified sewage water for irrigation has been practiced for many years without apparent deleterious effect to crops and soil. However, municipal or industrial effluents have limiting factors. Because of the wide tolerance limits of water quality for

recreational purposes the reuse of waste waters for this purpose are subject to only a few limitations. From available statistics, there appears to be much scope for a broader application of waste water reuse. (Selby-Texas)
W71-01981

ADVANCED TREATMENT OF MUNICIPAL WASTE WATERS IN THE UNITED STATES OF AMERICA,
Robert A. Taft Water Research Center, Cincinnati, Ohio.
F. M. Middleton.
Preprint, 1970 Conference of the Institute of Water Pollution Control (Southern African Branch), Cape Town, South Africa, 16-20 March 1970. 33 p, 7 tab, 3 fig, 11 ref.

Descriptors: *Water pollution control, *Waste water treatment, Legislation, Filtration, Screens, Biochemical oxygen demand, Chlorine, Mathematical models, Optimization, Water reuse.
Identifiers: *United States, Tube settlers, Carbon removal.

Water quality standards and the implementation of water pollution control measures in the United States make it necessary to improve on municipal waste water treatment. In addition to better removal of solids sand biodegradable carbon, high removals of phosphorus and nitrogen are being required. Legislation since 1965 and the substantial funds commited to research and building treatment plants indicates the U. S. is on a positive action cause to abate pollution from treatable sources. Better solids removal can be achieved by new filtration techniques, tube settlers, screening and use of chemicals. Better BOD removal is achievable through use of pure oxygen in place of air in activated sludge plants and dissolved organics are efficiently removed by activated carbon. Ozone and light-catalyzed chlorine may be useful ways to destroy organics. Chemical treatment of raw sewage or primary effluents followed by activated carbon treatment may be an alternate to conventional secondary treatment. A variety of phosphorus removal techniques based on chemical precipitation are available. Nitrogen removal methods are not yet available on a well-tested, large scale. Mathematical models and optimization techniques being developed will provide new useful tools for plant design. (Selby-Texas)
W71-01982

MARINE EFFLUENTS RESEARCH AND MARINE DISPOSAL OF EFFLUENTS,
G. R. Atkins.
Preprint, 1970 Conference of the Institute of Water Pollution Control (Southern African Branch), Cape Town, South Africa, 16-20 March 1970. 15 p, 3 fig, 6 tab, 3 ref.

Descriptors: *Effluents, *Disposal, *Oceanography, Testing, Thermal stratification, Salinity, Ocean currents, Diffusion, Bacteria, Degradation, Coliform.
Identifiers: *South Africa, Eddy diffusion coefficient.

South African coastal authorities became concerned over disposal of effluent in a popular resort beach area of False Bay. An investigation was carried out to determine effects of effluents disposal there. Oceanographic data obtained from the area were: (1) temperature determined by bathythermograph, (2) salinity by the inductive salinometer at zero and 100 feet depths, (3) wind records from coastal installations, and (4) currents measured by dye-bombs. Diffusion tests were conducted to establish the eddy diffusion coefficient. Coliform counts were also taken. Results of all tests concluded the False Bay area was not suitable for discharge of large quantities colored, toxic wastes or raw sewage. This is because major effluent discharge would be dependent on a continual renewal of water masses. This renewal only takes place, some degree during the summer. Temperature records indicate that the water masses during summer are very stable due to density layering. Winter isotherms show significant distortion with almost zero temperature gradients, i.e., potentially unstable conditions. Current movement in the bay is slow. Due to the shallow depth water, dilution coefficients were low. With regard to conditions close inshore, deep water and reasonable current speeds were encountered only on the rocky coastlines. Discharge into small bays must be avoided due to eddy formation or sanitation. (Selby-Texas)
W71-01983

CONSIDERATIONS ON THE DESIGN OF A SEWAGE PURIFICATION PLANT TO PRODUCE AN EFFLUENT SUITABLE FOR ADVANCED PURIFICATION,
W. M. Malan.
Preprint, 1970 Conference of the Institute of Water Pollution Control (Southern African Branch), Cape Town, South Africa, 16-20 March 1970. 8 p, 1 fig.

Descriptors: *Sewage treatment, *Design, Screens, Sedimentation, Activated sludge, Aeration, Color, Costs, Flow rates, Waste water treatment, Water reuse.
Identifiers: *South Africa, *Sedimentation tanks, Sand filtration.

It was decided by a South African community to abandon a pond system in favor of a conventional sewage purification plant. A large portion of effluent was intended for reuse by a paper mill and other industries which might move in later. An activated sludge plant was selected. Design considerations included, screening and grit removal, primary sedimentation, activated sludge treatment and aeration, secondary settling and activated sludge return. The two primary sedimentation tanks were 50 feet in diameter and provide an upflow velocity of 3.3 feet per hour. Rate of nitrification for the activated sludge treatment was found to be approximately 50 mg/l per hour. Three aeration modules, each capable of treating 0.67 million gallons of settled sewage per day were built. Each module consisted of 4 concentric orbal channels, with two final settling tanks in the middle. Aeration was provided by Huisman discs driven by electric motors. Each aeration module was provided with two secondary settling tanks each 40 feet in diameter. This provides an upflow velocity of 1.8 feet per hour. Two sand filter units each 10 feet by 12 feet were provided. At an initial filtration rate of 2 gallons per square foot per minute, these filters are capable of treating the effluent from one module (.67 million gallons per day). Backwashing can take place at a rate of 12 gallons per square foot per minute. Biologically purified sewage at the community contains normally 90 to 100 color units on the Hazen scale. Present requirements of the paper mill dictate a maximum of 40 units. It was decided to decolorize by means of chlorination and if necessary to supplement this later by flocculation. Costs of establishing and operating the plant are discussed. (Selby-Texas)
W71-01984

EFFLUENT MANAGEMENT BY JUDICIOUS INTEGRATION OF VARIOUS PROCESSES AND UTILIZATION OF TREATMENT PLANT BEYOND DESIGN CAPACITY,
H. C. Blersch, and H. A. De Villiers.
Preprint, 1970 Conference of the Institute of Water Pollution Control (Southern African Branch), Cape Town, South Africa, 16-20 March 1970. 17 p, 1 tab, 17 fig, 2 ref.

Descriptors: *Waste management, *Costs, *Design, Biological treatment, Sedimentation, Flow rates, Biochemical oxygen demand, Waste water treatment, Industrial wastes.
Identifiers: *Distillery wastes, *South Africa, Design capacity, Biological filtration.

Because capital investment in waste treatment facilities is generally governed by peak loads, high, short duration seasonal peaks tend to lead to disproportionate treatment costs. Insufficient specific data on the size and responsiveness to treatment of the peak load result in conservative design criteria which increase this tendency. Described is how costs were substantially reduced in a specific case by establishing design criteria for determining, through several years' experimental operation of full scale units on proportions of the wastes received, added to domestic sewage, (1) the effects of various degrees of seasonal overload, up to very high levels, on biological filtration plant, and (2) the capacity of a large pond area to buffer the effects of consequent seasonal deterioration in plant effluent. Brief reference is also made to the application of the fact that domestic sludge digesters can accept limited admixture wastes while handling their full domestic load. (Selby-Texas)
W71-01985

FLUIDIZED BED RECOVERS PROCESS CHEMICALS,
Chicago Co., Ill.
J. E. Hanaway, Jr.
Water and Wastes Engineering/Industrial Journal, Vol 7, No 5, p C14-C15, May 1970. 1 fig.

Descriptors: *Pulp wastes, *Waste treatment, Biochemical oxygen demand, Ohio River, Inorganic compounds, Oxidation.
Identifiers: *Waste liquor, Paper wastes, Container-Copeland Process.

The Wescor Corporation pulp and paper mill in Kentucky produces about 200 tons of wood pulp per day. The volume of weak waste liquor amounts to about 800 tons per day at a total solids concentration of about 10%, and contains about 36 tons per day of BOD. Treatment in the recovery system destroys more than 99% of the BOD and recovers more than 95% of the inorganic pulping chemicals. The Container-Copeland Process for the treatment is based on high temperature oxidation of the organic matter found in the waste liquor. Because of thermal characteristics of fluidized bed oxidation and the design features in the system, the oxidation is self-supporting, in that it operates on the fuel values contained in the waste liquor at relatively low solids, as compared to other types of oxidation furnaces which require liquor concentrated to 50 or 60% solids. Fluidized-bed oxidation under these conditions presents no explosive hazards. The process steps are described in detail. The on-stream factor of the system at the Wescor mill has averaged about 95% since the start-up in June 1967. (Selby-Texas)
W71-01986

MANAGEMENT OF FARM ANIMAL WASTES.
American Society of Agricultural Engineers, St. Joseph, Mich.

For sale by the American Society of Agricultural Engineers, St. Joseph, Mich. Price: $5.00. Proceedings National Symposium on Animal Waste Management, May 1966, 161 p. Michigan State University, ASAE Publication No. SP-0366.

Descriptors: *Farm wastes, *Management, *Public health, *Water pollution sources, *Livestock, *Waste disposal, *Slurries, *Lagoons, *Biological treatment, Waste storage, Physical properties, Odor, Distribution systems, Irrigation, Labor, Environmental sanitation, Sludge treatment, Incineration, Feeds.
Identifiers: Feedlot runoff, Production, High density systems, Handling, Slatted floors, Materials, Handling, Liquid manure, Equipment design, Waste management, Oxidation ditches, Composting, Kjeldahl nitrogen, Coprophagy.

The National Symposium on Animal Waste Management had three main objectives: (1) To delineate the problem of managing animal waste, (2) To evaluate our current technology in the management of our farm wastes (technology in the farm waste management was divided into methods

of handling, treatment, utilization, and disposal) and (3) To stimulate and give new direction to future research in solid wastes management. Fifty-one papers were presented representing eighty-nine professionals - from industry, campus and government; from manufacturing, research, extension and regulatory agencies; as animal scientists, bacteriologists, economists, engineers, and sanitarians. The last three pages of the publication are devoted to ASAE recommendation (ASAE R292): Uniform Terminology for Rural Waste Management. (See also W71-01993 thru W71-02033). (Christenbury-Iowa State)
W71-01992

PHYSICAL, CHEMICAL AND BACTERIOLOGICAL PROPERTIES OF FARM WASTES (BOVINE ANIMALS),
Michigan State Univ., East Lansing.
S. A. Witzel, E. McCoy, L. B. Polkowski, O. J. Attoe, and M. S. Nichols.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No. SP-0366, p 10-14, May 1966. 10 tab, 19 ref. USDI No. 8 RO1 SW 00042-02.

Descriptors: *Farm waste, *Waste disposal, *Cattle, *Biochemical oxygen demand, Chemical oxygen demand, Anaerobic conditions, Aerobic conditions, Hydrogen ion concentration.
Identifiers: *Lagoon flora, *Population equivalents, *Liquid manure, Liquid manure tank, Volitile solids, Plant response.

This report characterizes pollutants derived from farm animal (Bovine) waste. Wastes were collected from dairy bulls, dairy cows, and beef cattle. The wastes were analyzed for volume, suspended solids, percent BOD and COD. Further analysis show the effects of treating manure on yield and recovery of N, P, and K by corn plants. The data indicate that high concentrations of bacteria (dead or alive), volatile solids, BOD and COD are found in waste from bovine animals. The study indicated that reduction by lagoon retention, settling, aerobic or anaerobic digestion does not remove sufficient amounts of volatile solids, BOD and COD to provide safe effluent for disposal in streams. Indications are that liquid manure handling by farmers may be the most feasible approach for waste disposal. (See also W71-01992). (Christenbury-Iowa State)
W71-01993

DUCK-PROCESSING WASTE,
Robert S. Kerr Water Research Center, Ada, Okla.
For primary bibliographic entry see Field 05B.
W71-01994

HEALTH ASPECTS AND VECTOR CONTROL ASSOCIATED WITH ANIMAL WASTES,
Public Health Service.
For primary bibliographic entry see Field 05F.
W71-01995

BIOLOGICAL INTERRELATIONSHIPS BETWEEN FECES AND FLIES,
California Univ., Berkeley.
John R. Anderson.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No. SP-0366, Michigan State University, May 1966, p 20-23. 35 ref.

Descriptors: *Farm wastes, *Domestic wastes, Confinement pens, Livestock.
Identifiers: *Filth flies, *Livestock-husbandry operations, *Fly populations, Livestock production methods, High-density confinement.

This report discusses the effects on fly populations as affected by changes in livestock production methods. Field research has indicated that the foremost cause for the prodigious number of flies today is the recent widespread occurence of low-area, high-density concentrations of animals in all phases of livestock-husbandry operations. Although recent changes in livestock husbandry have created serious fly problems, the possibilities for constructively managing manure to avoid or reduce the production of flies under today's low-area, high-density confinement of animals appear much better than with previous technologies. (See also W71-01992). (Christenbury-Iowa State)
W71-01996

STORMWATER RUNOFF FROM CATTLE FEEDLOTS,
Kansas State Univ., Manhattan.
For primary bibliographic entry see Field 05B.
W71-01997

PHYSICAL PROPERTIES OF ANIMAL MANURES ASSOCIATED WITH HANDLING,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05A.
W71-01998

METHODS OF HANDLING POULTRY-WASTE MATERIAL,
Cornell Univ., Ithaca, N.Y. Dept. of Poultry Science.
C. E. Ostrander.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 32-33.

Descriptors: *Poultry, *Farm wastes, Waste storage, Waste disposal, Odors.
Identifiers: *Handling, High-density systems, Processing, Methods, Collecting.

This paper reports on manure handling methods employed in high-density poultry operations. Operations include: collecting, removal, storing, loading, spreading, processing and disposal. (See also W71-01992). (Christenbury-Iowa State)
W71-01999

PUMPING MANURE SLURRIES,
California Univ., Davis. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05E.
W71-02000

ENGINEERING PROBLEMS IN YEAR-ROUND DISTRIBUTION OF WASTE WATER,
Pennsylvania State Univ., University Park, Pa. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05E.
W71-02001

SLOPING FLOORS FOR BEEF-CATTLE FEEDLOTS,
California Univ., Davis.
S. R. Morrison, V. E. Mendel, and T. E. Bond.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 41-43. 3 tab, 4 fig, 3 ref.

Descriptors: *Cattle, *Farm wastes, Confinement pens, Performance, Disposal.
Identifiers: *Slatted floor, *Sloping floor, *Feedlots, Weight gains, Cattle behavior, Feed efficiency.

Limited tests on sloping floors for cattle feedlots indicate that slopes up to 7 deg do not depress weight gains or feed efficiency. A slope of about 5 deg is sufficient for removal of most of the manure, but unless some flushing arrangement is employed, manure will build up near the feed bunk. Stalls have little value in preventing this build-up. A slat-covered pit at the lower end of the slope allows manure to move freely off the floor and serves as a satisfactory storage. (See also W71-01992). (Christenbury-Iowa State)
W71-02002

MATERIALS HANDLING AND LABOR IN FREE-STALL AND LOOSE HOUSING,
Purdue Univ., Lafayette, Ind.
W. E. Schmisseur, C. M. Brown, Jr., J. L. Albright, W. M. Dillon, and A. C. Dale.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 43-45. 3 tab, 17 ref.

Descriptors: *Farm wastes, *Cattle, Disposal, Labor.
Identifiers: *Materials handling, *Free-stall, *Loose housing, Bedding.

In the winter and spring of 1964-65 Purdue University conducted two 6-month studies in Lafayette and Cuzco, Indiana, comparing free-stall to loose housing. For one free-stall comparison, 20 stalls were place in one-third of the area of each of two pole-type barns. The remaining areas were used for loose housing. Ninety cows were divided into four individual lots. Each free-stall unit housed 20 cows, with 25 cows in loose housing. All four lots were treated and handled similarly. Straw was used as bedding. Daily work sheets showing time used to bed the cows, scrape alleys, pounds of bedding used, and the pounds of manure removed daily were kept on all groups. Two pole-type barns were also used in the other free-stall comparison. One barn was used for loose housing; the other contained 32 free stalls; 26 animals were housed in each barn. Sawdust was used to bed all animals for half of the experiment; straw was used for the rest of the experiment. (See also W71-01992). (Christenbury-Iowa State)
W71-02003

CATTLE-MANURE HANDLING AND DISPOSAL SYSTEMS ON THE WEST COAST,
Washington State Univ., Pullman. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05E.
W71-02004

MACERATION FOR DISPOSAL OF DEAD POULTRY,
California Univ., Davis. Dept. of Agricultural Engineering.
J. A. Moore, and W. C. Fairbank.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 47-49. 2 fig, 2 ref.

Descriptors: *Farm wastes, Disposal, Farm lagoons, Septic tanks, *Waste disposal, *Poultry, Equipment slurries.
Identifiers: *Macerator, Composting, Thin bed drying, *Equipment design.

The development of a macerator for dead poultry is reported. Several initial designs were investigated. Combining all the findings of the preliminary investigation in the final design of the second chopper-type macerator has led to the development of a satisfactory dead-bird macerator. Systems for disposal of the macerated poultry are discussed and evaluated. Slurry systems, lagoons, heated septic tanks, artificial composting, and thin bed drying were judged to be satisfactory for disposing fo the macerated poultry. (See also W71-01992). (Christenbury-Iowa State)
W71-02005

WATER METABOLISM STUDIES MAY ASSIST WITH WASTE DISPOSAL,
Texas A and M Univ., College Station. Dept. of Poultry Science.
J. H. Quisenberry, D. D. Malik, and Ramon Ibarbia.

Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 49-51. 10 tab.

Descriptors: *Farm wastes, *Poultry, Waste disposal, Odor, Clays, Bentonite, Genetics, Confinement pens, Eggs diets.
Identifiers: Waste management, Water excretion, Drippings, Laying bird.

For many poultry operations, attempts to solve the waste-management problems can best be accomplished by concentrating on methods of obtaining dry or drying the droppings to a manageable level. Three methods have been tested and were reported in this paper. These are: (a) use of splashboards under cage operations, (b) genetic selection for low water excretors. Each of these has its appropriate place in bird management and should be used by poultrymen as their specific needs require. (See also W71-01992). (Christenbury-Iowa State)
W71-02006

DISPOSAL OF POULTRY MANURE BY PLOW-FURROW-COVER METHOD,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Agricultural Engineering.
Charles H. Reed.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 52-53. 1 tab, 4 ref.

Descriptors: *Farm wastes, *Poultry, *Waste disposal, Odor, Slurries, Furrows, Soil disposal fields.
Identifiers: *Waste management, *Plow cover, Liquid manure, Flies.

The disposal of liquid manure by the plow-furrow-cover technique appears to be an excellent conservation method. The upper soil layer is used as the disposal medium; there is no opportunity for flies to breed or even feed. In a closed handling system there are no detectable odors. With this method from 1 to 2 in. of slurry is deposited in a plowed furrow 6 to 8 in. deep. Immediately after deposition, a single-bottom plow covers the manure, making the next furrow; this can be done in one or two operations. Depositing and completely covering 2 in. of slurry, equivalent to 225 tons per acre, has been very successful. This paper describes the development of the method, the initial disposal programs, and the proposed experimental program to determine the maximum rate of disposal on a limited land area. (See also W71-01992). (Christenbury-Iowa State)
W71-02007

DISPOSAL OF HOUSEHOLD WASTES IN THE SOIL,
Southern Illinois Univ., Carbondale; and Ohio State Univ., Columbus.
J. H. Jones, and G. S. Taylor.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 53-55. 1 tab, 2 fig, 5 ref.

Descriptors: *Farm wastes, *Septic tanks, *Sewage disposal, *Conductivity, Soil disposal fields, Sewers, Construction, Absorption, Rural areas.
Identifiers: *Soil absorption, *Soil clogging, Household wastes.

Generally the most satisfactory method of disposing of human excreta and household wastes in rural areas is the septic tank soil sbsorption system. While studies show that this is a safe system of household wastes disposal, many systems are malfunctioning; a high percentage of these failures is due to soil absorption difficulties. Thus the utility of the system depends on the size of the absorption field, the waste load, soil conditions, and the construction and installation of the absorption field. This paper discussed the criteria that should be used when designing a septic-tank system. The factors affecting the satisfactory operation of the system are presented. Construction and installation practices are examined. Conditions affecting soil clogging are presented along with conductivity vs cumulative outflow graphs. (See also W71-01992). (Christenbury-Iowa State)
W71-02008

REQUIREMENTS FOR MICROBIAL REDUCTION OF FARM ANIMAL WASTES,
South Dakota State Univ., Brookings. Dept. of Bacteriology.
Edward C. Berry.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 56-58. 2 tab, 1 fig, 13 ref.

Descriptors: *Farm wastes, *Lagoons, *Biodegradation, *Sewage bacteria, Odor, Anaerobic conditions, Aerobic conditions, E. coli, Bacteria, Fungi, Actinomycetes, Protozoa, Algae.
Identifiers: *Chemical environment, *Physical environment, Phage, Fermentor, Facultative, Microaerophilic, Inoculation.

The cardinal principle on which all sanitation reduction work is based is to provide an environment in which the micro-organisms can bring about conversion of undesirable material to a non-offensive and stable state in the shortest possible time. To bring this about it is necessary to consider (a) the wastes we want reduced and their end products and (b) the organisms that we want to perform this chore for us. The micro-organisms involved in manure reduction are to be found in the following groups: (a) bacteria (aerobic, anaerobic, microaerophilic, facultative or obligate), (b) fungi, (c) actinomycete, (d) protozoa, (e) algae, and (f) phage. Each organism finds its optimum environment under fairly restricted environmental conditions. This paper gives examples of the most common micro-organisms and the effect the environment has on their activity. (See also W71-01992). (Christenbury-Iowa State)
W71-02009

AEROBIC TREATMENT OF SWINE WASTE,
Illinois Univ., Urbana.
R. L. Irgens, and D. L. Day.
Laboratory study is reported in more detail in 'Journal of Agricultural Engineering Research', 11: (1) 1-10, 1966, R. L. Irgens and D. L. Day. Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 58-60. 8 fig, 3 tab.

Descriptors: *Farm waste, *Aerobic treatment, *Aeration, Biochemical oxygen demand, Chemical oxygen demand, Oxidation.
Identifiers: Swine waste, Waste collection pits, Slotted-floor, Oxidation ditch.

From the results of these tests, it was calculated that for aerobic stabilization of the waste, about 6 cu. ft. of tank volume per pig would be required and approximately 1.2 lb 02 per lb of BOD (0.65 lb BOD per 125-lb pig per day), or 2500 cu. ft. of air pen lb of BOD at 3 per cent efficiency of oxygen utilization. The aerobic process for treating swine waste is odor-free and does not attract flies. The only gas that is produced is carbon dioxide which to a large extent will remain in solution as bicarbonate. The organic matter that is not oxidized to carbon dioxide and water is converted to stable solids, which are easily dewatered and dried on a sand bed. The effluent has a low BOD and is free from ammonia. It seemed feasible to develop an oxidation ditch inside a swine production bulding utilizing self-cleaning slatted floors. (See also W71-01992). (Christenbury-Iowa State)
W71-02010

OPERATING CHARACTERISTICS OF TWO AEROBIC-ANAEROBIC DAIRY MANURE TREATMENT SYSTEMS,
Massachusetts Univ., Amherst. Dept. of Agricultural Engineering; and New Holland Machine Co., Pa.
N. W. Webster, and J. T. Clayton.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No. SP-0366, Michigan State University, May 1966, p 61-65. 2 tab, 14 fig, 20 ref. USDI water research act of 1964 (Public Law 88-379).

Descriptors: *Farm wastes, *Anaerobic conditions, *Aerobic conditions, *Aeration, Sedimentation, Dissolved oxygen, Biochemical oxygen demand.
Identifiers: *Dairy manure, Aerators, Aeration tanks, Sedimentation tanks, Systems, Volatile solids.

Two aerobic waste-treatment systems were designed and tested for use in treating dairy manure. The systems were combinations of aeration and settlement for the purpose of reducing the pollution capabilities of the waste and to make it possible to use the treated effluent for transporting the fresh waste. The system utilizing anaerobic primary settlement and secondary aeration system was selected as the best suited for agricultural use. A system using primary aeration with secondary settlement did not operate satisfactorily. (See also W71-01992) (Christenbury-Iowa State)
W71-02011

ON-SITE COMPOSTING OF POULTRY MANURE,
Auburn Univ., Ala. Dept. of Agricultural Engineering.
J. R. Howes.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 68-69.

Descriptors: *Farm wastes, *Poultry, *Aerobic conditions, Microorganisms, Peat, Cellulose, Aerobic treatment.
Identifiers: *Composting, Fecal material, *Litter, Heat of composting, *Litterlife.

Although composting dates back to antiquity, the composting of poultry litter in situ is new. A culture of 46 species of micro-organisms was mixed into a base of peat and various minerals. This active mixture was spread at the rate of 1/2 lb. per sq. ft. on poultry litter that was at least 6 in. deep and contained an appropriate balance of cellulose and fecal material. Water used to clean the house interior was added to the litter and then mechanically mixed to initiate aerobic action. After heat of composting had subsided, birds were placed on the litter. This process is relatively inexpensive. It overcomes problems associated with obtaining and disposing of litter; provides odor and fly-free environments; permits birds to be safely replaced on the same litter shortly after diseased stock has been removed or the houses flooded; permits humidification of poultry houses; keeps dust to a minimum and enables house interiors to be washed, thus increasing sanitation and equipment efficiency. (See also W71-01992) (Christenbury - Iowa State)
W71-02013

PRIMARY TREATMENT OF SWINE WASTES BY LAGOONING,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
T. L. Willrich.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 70-74. 2 fig, 7 tab, 14 ref. U. S. Public Health Research Grant EF00410.

Descriptors: *Farm wastes, *Anaerobic conditions, *Design criteria, *Performance, Lagoons, Anaerobic bacteria, Chromatium, Rhodothece, Odor, Gases, Sludge.

Identifiers: *Sludge accumulation, *Swine wastes, *Waste treatment lagoons, *Anaerobic lagoons, Micro lagoons, Lagoon feeding, Gas production, Odor production.

A brief history of lagooning at Iowa State University is presented. The design and problems associated with operation of the lagoon are presented. Data was taken over a period of 8 years to arrive at recommendations for construction of lagoons. Factors discussed include: detention times and sludge accumulations, loading rates, lagoon performance, gas production, odor production, micro-lagooning, lagoon feeding, and design criteria. The recommended design criteria are: (1) For anaerobic lagoons which will receive fairly uniform and frequent (one-a-week or less) loadings: allow a minimum of 1 cu. ft. of lagoon water volume per pound of total animal weight confined in a hog-finishing building, plus additional lagoon volume for sludge storage. (2) For lagoons which will recieve non-uniform and intermittent loading: allow a minimum of two cu. ft. of lagoon water volume per pound of total animal weight confined in a hog-finishing building, plus additional lagoon volume for sludge storage. (See also W71-01992) (Christenbury-Iowa State)
W71-02014

DESIGN CRITERIA FOR ANAEROBIC LAGOONS FOR SWINE MANURE DISPOSAL,
Nebraska State Dept. of Health, Lincoln.
David R. Curtis.
Proceedings National Symposiun on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 75-80. 5 fig, 5 tab.

Descriptors: *Farm wastes, *Anaerobic conditions, *Chemical oxygen demand, *Biochemical oxygen demand, *Odor, *Hydrogen ion concentration, Lagoons, Temperature, Oxidation-reduction potential, Alkalinity.
Identifiers: *Kjeldahl nitrogen, *Volatile acids, *Swine waste, Anaerobic lagoons.

On-site investigations were conducted at 10 selected lagoons to confirm data collected through questionnaires and to observe the actual operation. Data collected included: Number of swine served, sketch of the plan and elevation views, chemical data on samples collected at various times during the study, and a typical cross section of the lagoons showing how solids have accumulated. The temperatures in the lagoons ranged from 70 to 80 F, with temperatures of 75 F and above more prevalent. Oxidation reduction potential (ORP) data indicated that anaerobic conditions were present at all times in the lagoons. Chemical analyses have proved to be effective diagonostic instruments in evaluating the probable cause of objectional odors from lagoon installations. The determinations of greatest significance were pH, Kjeldahl nitrogen, volatile acids, alkalinity, BOD and COD. Design criteria for hog lagoon installations for Nebraska are given. Operational procedures are outlined that should improve the chances for successful lagoon operations. (See also W71-01992) (Christenbury-Iowa State)
W71-02015

CATTLE-MANURE TREATMENT TECHNIQUES,
Kansas Univ., Lawrence. Dept. of Civil Engineering.
R. W. Agnew, and R. C. Loehr.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 81-84. 1 fig, 5 tab, 10 ref.

Descriptors: *Farm wastes, *Lagoons, *Anaerobic digestion, *Aeration, Activated sludge, Solid wastes, Runoff, Chemical oxygen demand, Biochemical oxygen demand, Laboratory tests, Alkalinity.
Identifiers: *Waste characteristics, *Polishing unit, *Anaerobic lagoons, *Aeration systems, Settled solids, Solids handling, Solids disposal, Runoff control, Volatile acids, Kjeldahl nitrogen.

The characteristics of commercial lagooning operations were discussed. It was pointed out that there was a need for extensive planning in the design and operation of lagoons. It was suggested that a combination of an anaerobic lagoon and an aeration unit may be most practical for most installations. Data was presented and discussed concerning the characteristics of anaerobic lagoons, aeration systems, and the settled solids. A potential treatment facility was proposed and discussed as to the cost, colids handling, solids disposal, efficiency, and runoff control. (See also W71-01992) (Christenbury-Iowa State)
W71-02016

DEWATERING CHICKEN MANURES BY VACUUM FILTRATION,
Clarkson Coll. of Technology, Potsdam, N.Y., and New York State Dept. of Health, Albany.
E. A. Cassell, A. F. Warner, and G. B. Jacobs.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 85-91. 5 tab, 9 fig, 32 ref. N.Y. State Dept. of Health (Contract No. C-18768).

Descriptors: *Farm wastes, *Sludge treatment, *Poultry, *Dewatering, Laboratory tests, Sewage sludge, Filtration, Municipal wastes.
Identifiers: *Sludge conditioners, *Vacuum filtration, Chemical-sludge conditioners, Conditioner dosage, Liquid requirements, Solids demand.

The sludge conditioning and vacuum filtration characteristics of sewage sludges and chicken manures were found to be vastly different. Most of the sewage sludges were dewatered with FeC13, FeC13 and lime conbinations, cationic polyelectrolyte, and non-ionic polyelectrolyte sludge conditioners. None of these effectively promoted the dewatering of chicken manures. On the other hand, the anionic polyelectrolyte effectively dewatered chicken manure, but not the sewage sludges. The anionic polyelectrolyte can reduce the specific resistance of chicken manures by as much as a factor of 15 and produce filter cakes with as high as 25 percent total solids. (See also W71-01992) (Christenbury-Iowa State)
W71-02017

REMOVAL OF MOISTURE FROM POULTRY WASTE BY ELECTRO-OSMOSIS (PART I),
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
Otis E. Cross.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 91-93. 7 fig.

Descriptors: *Farm wastes, *Dewatering, *Electro-osmosis, Laboratory tests, Cathodes, Poultry.
Identifiers: Moisture distribution, Expelling water.

This investigation was designed to determine the effectiveness of expelling water from poultry excrement by the electro-osmosis phenomena. Three factors were selected as being the most critical: amount of electric current, time, and distance between electrodes. Twelve plastic tubes were placed in a horizontal position. Each tube was 2 in. ID and 65 cm. long. The piston-type anode was carbon and maintained constant pressure upon the excrement sample by means of a weighted-lever arrangement. The cathode was a 1 mm. copper screen. The tests were conducted with three sample lengths: 40, 25, and 10 cm. The electro-osmosis phenomena produced a 57 percent decrease in moisture content. The amount of expelled water was a function of current flow, time, length of sample, and moisture content of the sample. (See also W71-01992) (Christenbury-Iowa State)
W71-02018

REMOVAL OF MOISTURE FROM POULTRY WASTE BY ELECTRO-OSMOSIS (PART 2),
Michigan State University, East Lansing. Dept. of Agricultural Engineering.
F. V. Nurnburger, C. J. Mackson, and J. Davidson.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 93-95. 7 fig.

Descriptors: *Farm wastes, *Electro-osmosis, *Dewatering, Poultry.
Identifiers: *Joule heating, *Gravity flow, Current flow.

This investigation was undertaken to study the effects of various electrode materials on the liquid expelled from chicken excrement by the process of electro-osmosis. It utilized the effects of joule heating and gravity flow. The results from using 5, 10, 15, and 20 v d-c were that 20 v d-c gave the best results. Of the three materials used, stainless steel gave the best performance, copper was the poorest, and steel was intermediate. The maximum moisture-content reduction was 4.8 percent wb based on 22 hr. of operation at 20 v. This was not sufficient to reach a pelletable level from the initial value of 80 percent wb. The cost of the electric energy used was 12.7 cent per gallon of liquid removed based on the rate of 2 cent per Kw-hr. (See also W71-01992) (Christenbury-Iowa State)
W71-02019

DESTRUCTION OF CHICKEN MANURE BY INCINERATION,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Engineering.
A. T. Sobel, and D. C. Ludington.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 95-98. 2 tab, 4 fig, 12 ref. N.Y. State Department of Health (Contract No C18965).

Descriptors: *Farm wastes, *Incineration, Poultry, Laboratory tests, Heat balance, Natural resources.
Identifiers: *Combustion, *Solid fuels, Volatile solids, Mass balance, Fixed carbon, Ash, Heat of combustion, High heat value, Low heat value, Energy balance.

The volatile solids in chicken manure represents considerable energy. Incineration is a process which utilizes this energy for destruction of the organic portion of the manure. The application of existing combustion theory to the incineration of chicken manure is difficult beacuse of lack of basic property information and the variability of the material. The incineration process is very dependent on the moisture content of the manure. A laboratory incinerator has been constructed to investigate the incineration process. Initial trials of the incinerator have been restricted to partially dried manure. Considerable information has been obtained. Future application of incineration will depend on cost factors and possible air pollution hazards. A mass and heat balance for a typical incineration trial is given in an Appendix to the paper. (See also W71-01992) (Christenbury-Iowa State)
W71-02020

TREATMENT OF DUC. WASTES AND THEIR EFFECTS ON WATER QUALITY,
Virginia State Water Control Board, Richmond.
R. V. Davis, C. E. Cooley, and A. V. Hadder.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 98-105, 10 tab, 7 ref.

Descriptors: *Farm wastes, *Coliforms, *Poultry, *Oysters, *Water quality, Salmonella, Biochemical oxygen demand, Environmental effects, Settling basins.
Identifiers: *Rappahannock River, Pilot pond, Barnhardt Farms, Inc., MPN (Most probable number), Raw wastes, Duck run.

Early in 1963 a six-month study was undertaken to determine the effect of coliform organisms in the treated wastes from two duck farms on water quality in an oyster-producing and recreational area of the Rappahannock River near Urbanna, Virginia. Before the treatment facilities were installed, water quality in the area was questionable for recreation purposes and was restricted for direct marketing of shellfish. Treatment consists of alternately used earthen settling basins for removing solids, followed by 4-day retention earthen basins. These remove essentially all settleable solids and reduce the most probable number of coliform organisms per 100 ml. by 90 to 95 percent. On the basis of data collected from the river, restrictions from the public oyster beds were lifted. Satisfactory recreational water quality now exists throughout the area, except very near the discharges. (See also W71-01992) (Christenbury-Iowa State)
W71-02021

VALUE OF BROILER LITTER AS FEED FOR RUMINANTS,
Virginia Polytechnic Inst., Blacksburg; Cornell Univ., Ithaca, N.Y.; and Kansas State Univ., Manhattan.
J. P. Fontenot, A. N. Bhattachanya, C. L. Drake, and W. H. McClure.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 105-108. 7 tab, 11 ref.

Descriptors: *Farm wastes, *Poultry, *Sheep, *Cattle, *Feeds, Proteins, Metabolism, Ruminants, Feeding rates.
Identifiers: Nutritive value, Broiler litter, Digestible protein, Digestible energy, Metabolizable energy, Total digestible nutrients, Carcass grade, Rate of gain.

Information has been presented concerning the nutritive value of broiler litter for ruminants. The litter samples analyzed contained an average of 32 percent crude protein, dry basis. In autoclaved litter, true protein accounted for 45 percent of the total nitrogen. In metabolism trials with wethers, 25 and 50 percent autoclaved peanut-hull and wood-shaving broiler litters replaced corresponding amounts of a corn-hay ration. There were no significant differences in digestible protein, digestible energy, metabolizable energy, and TDN content between kinds and levels of litter. Average values were 22.7 percent, 2440 kcal per kg, 2181 kcal per kg, and 59.8 percent, respectively. It was found in fattening trials that rate of gain and carcass grade were not significantly different for beef steers fed mixtures containing 25 percent ground peanut-hull or wood-shaving broiler litter than for those fed a conventional fattening mixture. (See also W71-01992) (Christenbury-Iowa State)
W71-02022

UTILIZATION OF ANIMAL WASTE AS FEED FOR RUMINANTS,
Auburn Univ., Ala. Dept. of Animal Science.
Aw. brady Anthony.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 109-112. 13 tab, 23 ref.

Descriptors: *Farm wastes, *Cattle, *Chemical analysis, Feeds, Silage, Nutrients, Amino acids, Vitamins.
Identifiers: *Feedlot manure, *Steers, *Digestion coefficients, *Average daily gain, Manure, Carcass data.

Analysis of feedlot manure showed it to be a valuable source of vitamins and amino acids. Washed manure was mixed with a concentrated feed and successfully fed to steers. When unwashed manure was combined with a concentrated mixture or with silage and fed to steers, animal gain and feed efficiency were not improved. Fresh feedlot manure proved to be a valuable ration component when it was either washed or autoclaved. Fresh feedlot manure was blended with coastal bermudagrass hay to make a palatable and nutritious low-moisture silage. (See also W71-01992) (Christenbury-Iowa State)
W71-02023

COPROPHAGY AND USE OF ANIMAL WASTE IN LIVESTOCK FEEDS,
Texas Tech. Univ., Lubbock.
R. M. Durham.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 112-114. 6 tab.

Descriptors: *Farm wastes, *Feeds, *Livestock, Poultry, Cattle, Catfishes, Sheep, Swine, Eggs.
Identifiers: *Coprophagy, *All-concentrate ration, Feedlot steers, Digestion coefficient.

This paper reports observations of coprophagy in cattle consuming an all-concentrate ration and the feeding of rations containing manure from these cattle to poultry, cattle, swine and catfish. The all-concentrate ration was composed of 89% ground milo, 10% cottonseed meal and 1% vitamin-mineral supplement. The manure was ground in a hammer mill without prior drying and mixed with other ration ingredients for feeding. Coprophagy has been observed in cattle consuming limited quantities of the all-concentrate ration. All-concentrate cattle manure has been successfully fed to growing pullets and laying hens. The all-concentrate manure has been fed to feedlot steers with generally favorable results to limit feed consumption. Catfish can make rapid gains on feedlot manure if care is taken to prevent oxygen depletion. (See also W71-01992) (Christenbury-Iowa State)
W71-02024

ROLE OF THE RENDERER IN THE USE AND DISPOSAL OF ANIMAL WASTES,
Triangle E By-Products Co., Harrisonburg, Va.
E. L. Foerster, Sr.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 114-117.

Descriptors: *Farm wastes, Poultry, Cattle, Chemical analysis, Economics, Disposal, Equipment, Digestion tanks, Nutrients.
Identifiers: *Rendering, *Fallen stock, Protein content, Coprophagy.

Mr. Foerster gives a general history of the rendering industry in the United States. He explains the role of the industry in disposing of fallen animals. He gives an analysis for a typical product from a rendering plant. Some data is presented concerning the economics of the rendering process. Through cooperation, the rendering plant can provide a useful and efficient service in disposing of fallen stock. (See also W71-01992) (Christenbury-Iowa State)
W71-02025

EVALUATING ADAPTABILITY OF PASTURE GRASSES TO HYDROPONIC CULTURE AND THEIR ABILITY TO ACT AS CHEMICAL FILTERS,
Agricultural Research Service, Beltsville, Md.; and Maryland Univ., College Park.
Harry J. Eby.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 117-120. 6 fig.

Descriptors: *Farm wastes, *Hydroponics, *Effluents, Nutrients, Municipal wastes, Lagoons, Grasses, Aquatic environment, Root development, Light penetration.
Identifiers: Plant-nutrient removal percentage, Fertilizer value, Nutrient extraction potential, Surface area.

The possibility of using hydroponics as a means of removing nutrients from sewage-treatment plants and lagoons is discussed. Several grasses were studied with rye and tall fescue showing the most promise. Data is presented in graph form showing the plant-nutrient removal percentages. Two appendices are given. Appendix I shows the projected yield capabilities of the various forage grasses with the nutrient-extraction potential based on laboratory-scale sampling. Appendix II shows the method for computing the size of the hydroponic system required for any given volume of effluent. (See also W71-01992) (Christenbury-Iowa State)
W71-02026

PROBLEMS OF CATTLE FEEDING IN ARIZONA AS RELATED TO ANIMAL-WASTE MANAGEMENT,
Arizona Univ., Tucson. Dept. of Agricultural Economics.
Thomas M. Stubblefield.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 120-122. 11 ref.

Descriptors: *Farm wastes, *Cattle, *Legal aspects, Relocation, Area development, Odor, Arizona.
Identifiers: *Cowtowns, *Feedlots, Metropolitan areas, Manure.

Problems associated with locating large numbers of cattle near metropolitan areas are discussed. The particular problems with large feeders in Arizona and their solutions are presented. Feedlot manure selling for as high as $5 per ton in the 1940's now is a liability costing $1 to $1.50 per ton to remove. It has been advantageous for the feedlots to relocate near farming areas for more efficient disposal of the manure. To circumvent problems with residential areas, 'cowtowns' are being developed. (See also W71-01992) (Christenbury-Iowa State)
W71-02027

ECONOMIC EVALUATION OF LIQUID-MANURE DISPOSAL FOR CONFINEMENT FINISHING OF HOGS,
Illinois Univ., Urbana. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 05E.
W71-02028

ECONOMICS OF LIQUID-MANURE DISPOSAL FROM CONFINED LIVESTOCK,
Purdue Univ., Lafayette, Ind. Dept. of Agricultural Economics.
W. H. M. Morris.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 126-131. 6 tab, 1 fig, 16 ref.

Descriptors: *Farm wastes, *Cost analysis, *Disposal, *Value, *Nutrients, Chemical oxygen demand, Biochemical oxygen demand, Cost comparison, Economic feasibility, Economics, Anaerobic conditions, Aerobic treatment, Liquid wastes, Irrigation.
Identifiers: *Production model, Losses in storage, Value of manure, Utilization, Oxidation ditches.

Some of the problems in estimating the costs and returns from handling manure have been discussed. Removal of the manure from the livestock production areas has not been discussed. In general, the scale and efficiency of the operation and prevention of dilution of the manure determine if the manure can be spread in the fields at a cost equal to or less than the value of the nutrients used by the crop. Aerobic and anaerobic treatment of manure in special low-cost facilities designed for use on the farm seem to be practical solutions. No profitable method of industrial utilization of livestock manure can be forseen. (See also W71-01992) (Christenbury-Iowa State)
W71-02029

POULTRY MANURE MARKETING,
Pennsylvania State Univ., University Park.
Herbert C. Jordan.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 132-133.

Descriptors: *Farm wastes, *Marketing techniques, Fertilizers, Poultry analysis, Value, Economics.
Identifiers: *Bagging, *Processing.

A survey was conducted between 1961 and 1963 concerning marketing poultry manure. Information concerning the following topics was collected: General, Bagging Manure, Processing, Supplemental Mixture, and Marketing. Cost associated with bagging and minimum analysis (nitrogen, phosphoric acid, potash) is given for bags ranging from 2.5 to 80 pounds per bag. A summary of the data is presented pointed out that fresh manure is worth about $5 a ton to the soil ($20 per ton on a dry weight basis). Poultry manure used as an organic soil conditioner is and perhaps will remain the greatest and most common use of poultry manure. (See also W71-01992) (Christenbury-Iowa State)
W71-02030

FARM-WASTE MANAGEMENT TRENDS IN NORTHERN EUROPE,
Minnesota Univ., St. Paul. Dept. of Agricultural Engineering.
E. P. Allred.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 133-136. 1 fig.

Descriptors: *Farm wastes, *Disposal, Equipment.
Identifiers: *Northern Europe, Family-size farm, Oxidation ditches, Disposal practices.

Farmers throughout most of northern Europe are faced with many of the same waste-disposal problems as those confronting American farmers. Methods and equipment used for waste disposal are discussed with emphasis on the 'family-size' farm. Those individuals working with oxidation ditches are quite optimistic with its performance. When one compares rural waste-disposal practices in Europe with those in America, there are noticeable differences in both equipment and methods. Surprisingly the greatest differences occur, however, in the people themselves and their attitude toward rural waste disposal. (See also W71-01992). (Christenbury-Iowa State)
W71-02031

PLANT RESPONSE TO MANURE NUTRIENTS AND PROCESSING OF ORGANIC WASTES,
Forschungsanstalt fuer Landwirtschaft, Brunswick (West Germany).
Cord Tietjen.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 136-140. 3 tab, 9 fig, 12 ref.

Descriptors: *Farm wastes, *Liquid wastes, *Nutrients, Urine, Nitrogen cattle, Swine, Fertilizers.
Identifiers: *Gulle, *Plant response, Plant nutrients, Manuring, Feces.

To produce gulle (liquid manure) from cattle feces and to apply it for manuring, the grassland has for a long time been the common way of disposal of animal waste in the Alpine foreland. New labor-saving barn arrangements, tools and implements promote the practice of gulle utilization both for grassland and cropland. It was learned by field and pot experiments that gulle can exert a strong influence on plant growth. The physiological efficiency of gulle nitrogen is several times higher than that of nitrogen in common barnyard manures. Range of variation is great depending on gulle processing and composition. Quality of manure, its contents and ratio of plant nutrients depend on kind of animals, individual properties of animals, feeding, dilution by water or other additives, barn arrangement, collection and storage facilities. It is recommended that animal excrement be processed to a standardized manure - a full gulle that can be characterized by its ratio of plant nutrients. (See also W71-01992). (Christenbury-Iowa State)
W71-02032

BIOLOGICAL TREATMENT OF ANIMAL WASTES,
Netherlands Rijkswaterstaat, Arnhem.
Henri M. J. Scheltinga.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 140-143. 7 tab, 3 fig, 10 ref.

Descriptors: *Farm wastes, *Activated sludge, *Biological treatment, Swine, Laboratory tests, Nitrogen, Cost, Biochemical oxygen demand.
Identifiers: *Nitrogen balance, *Holland, *Oxidation ditch, Nitrification, Bio-industries.

This paper discussed treatment of farm wastes in Holland. Chemical and mechanical treatment alone have not proven satisfactory. Laboratory and full scale treatment experiments have been conducted. Aeration, anaerobic decomposition, activated sludge treatment, and oxidation ditch experiments have been performed. Foaming has been experienced in some tests. Nitrification and nitrogen balance for farm wastes are discussed. The cost associated with the treatment facilities were considered. (See also W71-01992). (Christenbury-Iowa State)
W71-02033

THE EFFECTS OF FARMYARD MANURE ON MATRIC SUCTIONS PREVAILING IN A SANDY LOAM SOIL,
National Vegetable Research Station, Wellesbourne (England).
P. J. Salter, G. Berry, and J. B. Williams.
Journal of Soil Science, Vol 18, No 2, 1967, p 318-328. 3 fig, 2 tab, 25 ref.

Descriptors: *Farm wastes, *Soils, *Soil moisture, Field capacity, Wilting point, Equations.
Identifiers: *Soil matric suctions, Ryegrass, Available-water capacity, Moisture characteristic.

Soil matric suctions under a crop of ryegrass on farmyard manure-treated and untreated plots were determined over a total period of 24 weeks from March to November. The soil moisture characteristic of each plot was determined five times throughout this period, and for each plot and on every occasion a linear relationship was found between moisture content and log matric suction. A formula was derived to account for the seasonal changes in moisture characteristic - and it was then possible to obtain matric suction values from the soil moisture contents obtained from twice-weekly sampling of each plot. Although differences between available-water capacity of the manured and unmanured plots were small throughout the 6-month period of sampling, the soil matric suctions of the manured plots were almost always lower than those of the unmanured plots. The lower suctions prevailing in the manured soil could be a factor contributing to the higher yields of ryegrass obtained from the manured plots as compared with those obtained from the unmanured plots. (White-Iowa State)
W71-02034

STREAM ENRICHMENT FROM FARM OPERATIONS,
Wisconsin Univ., Madison.
Neal E. Minshall, Stanley A. Witzel, and Merle S. Nichols.
Journal of the Sanitary Engineering Division, Proceedings of ASCE, Vol 96, No SA2, April 1970, p 513-524. 2 fig, 5 tab, 4 ref.

Descriptors: *Farm wastes, *Fertilizers, *Runoff, Nitrogen, Phosphorus, Potash, Wisconsin, Water pollution, Nutrients, Precipitation, Rates of application, Corn, Frozen ground.
Identifiers: *Nutrient losses, Collection tanks.

In order to obtain information on the amount of fertilizer materials lost in runoff water from farm lands under cultivation, eight plots, 10x40 ft. in size, were established on the University of Wisconsin Agricultural Experiment Station Farm near Lancaster, Wisconsin. Investigations involving fertilizer and manure applications and losses in surface runoff were begun in 1966 and were continued through 1969. Each plot was completely surrounded by a galvanized metal border which prevented surface runoff from entering or leaving the plots, located on a 10% to 12% slope. Runoff was collected in a trough at the lower end and funneled to a measuring tank. Manure was applied at the rate of 15 tons per acre in the winter and spring. Later corn was planted in 30 inch rows on the contour. Up to 20% of N, 13% of P, and 33% of K nutrients in winter applied manure, on frozen ground, may be lost under conditions favoring maximum early spring runoff. Nutrient losses in surface runoff from plots having manure applied in the summer and incorporated into the soil were less than from check plots, which received no manure. (White-Iowa State)
W71-02035

MANURE MANAGEMENT - COSTS AND PRODUCT FORMS,
Los Angeles County Agricultural Extension Service, Calif.
J. Van Dam, and C. A. Perry.
California Agriculture, Vol 22, No 12, December 1968, p 12-13. 2 tab, 2 fig.

Descriptors: *Farm wastes, *Cattle, *Marketing, *Costs, Volume, Profit, Management.
Identifiers: *Feedlots, *Processing plant, Stockpiles, Packaging, Bulk, Pulverizer, Product forms, Delivery, Removal.

A study to determine the actual cost of removal and disposal of manure from a beef feedlot in Los Angeles County was completed by the Agricultural Extension Service. Manure was prepared for marketing in three basic forms and sold under four pricing conditions. Manure processing, packaging and marketing began with the mounding of the manure in the corrals followed by its removal to a compost stockpile. Manure was allowed to cure in a compost pile at least six months before processing. The manure could then be marketed unprocessed as composted manure; marketed processed as composted bulk; and marketed processed as composted packaged manure. The combined fixed and variable costs per cubic yard amounted to 10.5 cents for the unprocessed product, 65 cents for the processed bulk and $1.88 for the packaged processed form. The weighted average price received per cubic yard was $3.80 for the packaged, $2.40 for the processed bulk, and $1.40 for the unprocessed bulk manure. A livestock feedlot operator can probably make a profit from the sale of manure. (White-Iowa State)
W71-02037

OXIDATION DITCHES FOR WASTE DISPOSAL,
Illinois Univ., Urbana. Dept. of Agricultural Engineering.
Donald L. Day.
International Journal Of Farm Building Resources, No 2, December 3, 1968, p 2-7. 9 fig, 9 ref.

Descriptors: *Farm wastes, *Hogs, *Biochemical oxygen demand, *Rotors, Foaming, Sludge, Effluent, Odors, Carbon dioxide, Oxygen, Depth, Dissolved oxygen, Electric power, Electric power costs, Volume, Velocity.
Identifiers: *Oxidation ditch, Population equivalent, Suspended solids, Slatted floors, Extended aeration.

The oxidation ditch is an efficient low-cost process for the treatment of municipal waste. It has several aspects that seem desirable for use in confinement livestock waste-treatment systems. The aerobic method is an odorless process with final products of water, carbon dioxide, and stable minerals. The oxidation ditch can be integrated into a self-cleaning slatted floor system. However, control of foaming is an immediate problem that must be solved before the process can be unconditionally recommended, even just for control of the odors in the gutter and when spreading on land. Operational criteria must be developed if the method is to serve for complete treatment of livestock manure, with an effluent that can be accepted by public health and water board standards. Adaptations of the oxidation ditch for the treatment of livestock manure are surely forthcoming, in view of the intense research that is in progress in the United States and abroad. However, until the current problems are resolved, the disposal of livestock manure in a manner that does not have an odor nuisance and a water pollution hazard remains a complicated problem. (White-Iowa State)
W71-02042

DRYING POULTRY MANURE INSIDE THE POULTRY HOUSE,
Pennsylvania State Univ., University Park. Dept. of Poultry Science.
Glenn O. Bressler.
Agricultural Engineering, Vol 51, No 3, p 136, March 1970.

Descriptors: *Farm wastes, *Poultry, *Drying, Ventillation, Waste storage.
Identifiers: *Poultry manure.

In this drying system droppings are removed at a very low moisture level, cutting weight of material to be handled by two-thirds. Eight 3000-cfm circulating fans are mounted about 22 ft. apart directly below 2 lines of water troughs that run the full length of the house. Fans are about 10 in. above the manure; air velocities over the droppings are about 250 to 750 fpm. A spike-tooth harrow is pulled daily through the accumulating droppings to stir them and to draw partially dried droppings into the high-velocity airstream. From the pit the droppings go either to truck or manure spreader or to a hammermill to be finely ground and bagged. The amount of water removed daily to prevent excess humidity and to dry the manure ranged from 6-9 gallons per hour. These results are from a flock of 3246 pullets and cockerels at 22 weeks in a 30-ft. by 100-ft. environment-controlled laying house. (White-Iowa State)
W71-02043

SWINE MANURE -- LIABILITY OR ASSET,
Purdue Univ., Lafayette, Ind.
David H. Bache.
Paper presented at the American Pork Conference, Des Moines, Iowa, March 3, 4, and 5, 1970. 13 p, 10 ref.

Descriptors: *Farm wastes, *Economics, *Costs, Water pollution, Air pollution, Confinement pens, Storage capacity, Fertilizers, Swine, Cattle, Poultry, Lagoons, Odor, Oxidation, Legislation.
Identifiers: *Assets, *Liability, Slatted floors, Land disposal, Innovators penalty, Pollution abatement grants.

Swine manure is a very modest asset on crop farms and it can be a major liability on those production units with no crop land base. A literature and research review gives costs and economic value of different manure treatment systems through the past ten or fifteen years. Conclusions reached include: there is no waste disposal problem with a pasture system, there is no economically feasible alternative to the spreading of solid manures, smaller swine production units will probably find that lagoon disposal is the optimum technique for handling hog wastes, and larger production units will be shifting to the use of slatted-floors, under floor manure forage, and liquid disposal systems. Public concern and legislation is discussed. (White-Iowa State)
W71-02047

PROCEEDINGS OF ANIMAL WASTE MANAGEMENT CONFERENCE.
Federal Water Pollution Control Administration, Kansas City, Mo.

Kansas City, Department of the Interior, February 1969. 40 p.

Descriptors: *Farm wastes, *Cattle, *Water pollution control.
Identifiers: *Feedlot pollution control, *State status reports, Animal production, Model feedlot regulation, Animal waste management.

An objective of the conference was to review the problem, as it exists today, of animal waste management. Information was given on how to conduct a state inventory of feedlots. A report was given on the Kansas animal waste control program. Control devices for animal feedlot runoff were discussed. The results of some feedlot pollution control research in Colorado and Nebraska was given. Status reports of 9 state pollution control programs were given, as well as model feedlot regulation design. (White-Iowa State)
W71-02049

WATER SUPPLY AND POLLUTION CONTROL PLANS FOR VOLUSIA COUNTY, FLORIDA.
East Central Florida Regional Planning Council, Titusville.

Available from NTIS as PB-190 810, $3.00 in paper copy, $0.95 in microfiche. Volusia Council of Governments Report, March 1970. 275 p, 26 tab, 17 ref.
Identifiers: *Water supplies, *Florida, *Sanitary engineering, Urban planning, *Water pollution, Control, Sewage, Population, Costs, Water resources, *Volusia County (Fla), Regional planning and development.

The report presents the findings of a long-range planning study to determine water and sewerage facilities requirements for Volusia County at the year 2000.
W71-02050

INVESTIGATION OF PERFORMANCE CHARACTERISTICS FOR SANITARY PLUMBING FIXTURES.
National Bureau of Standards, Washington, D.C. Building Research Div.

Available from NTIS as PB-189 456, $0.70 in paper copy, $0.95 in microfiche. NBS Building Science Series B5522, Jan 1970. 68 p, 30 tab, 25 fig, 38 ref.
Identifiers: *Sanitary engineering, Test methods, Reinforced plastics, Wear resistance, Glass textiles, Shock resistance, Thermal shock, Defects (Materials), Specifications, Impact shock, Performance (Engineering), Standards, *Plumbing fixtures.

The report gives findings and recommendations developed during an investigation of performance characteristics for sanitary plumbing fixtures. The report describes the test methods that are recommended for the evaluation of 16 performance characteristics, and the nature of further work required to complete the development of four or five additional test procedures. The suitability of various existing test methods for evaluating the functional and performance characteristics of sanitary plumbing fixtures was investigated in the laboratory. In addition, new or modified tests for certain characteristics were developed. The laboratory work was performed only on bathtubs and flat specimens provided by industry. Field inspection trips were made to provide the NBS project staff with up-to-date information on certain manufacturing processes and on installation and use problems. The complexities involved in the selection of valid performance levels are discussed, as well as the elements of judgment involved. A format that might be used in specifying performance is suggested for each test procedure and the rationale underlying each suggested format is given.
W71-02052

SPECIAL REPORT: COOLING TOWERS.

Industrial Water Engineering, Vol 7, No 5, p 22-53, May 1970.

Descriptors: *Cooling towers, *Thermal pollution, *Cooling water, Industrial water, Heat transfer, Evaporation, Heat balance, Vapor pressure, Thermal power plant, Environmental effects.
Identifiers: Impact of cooling towers.

A special report consisting of several contributions is presented. This report is divided into five sections: (1) tower section; (2) water-consumption; (3) chemical treatment; (4) automatic controls; and (5) field evaluation of the tower. The use of evaporative cooling towers rather than once-through systems could increase the cost of generating power by as much as 5%. Cooling tower selection is dependent on (1) amount of cooling water, (2) entering water temperature, (3) leaving water temperature, (4) temperature of the air entering the tower. The possibility of water reuse is discussed. The cooling operation can be automated and automatic control systems are described. Four types of pollution exist, thermal, steam, air, and land which have to be taken into account when towers are considered. (Novotny-Vanderbilt)
W71-02064

COOLING TOWER DESIGN CRITERIA AND WATER TREATMENT,
Black and Veatch, Kansas City, Mo.
F. W. Motley, and T. C. Hoppe.
Cooling Tower Institute Meeting, Aspen Colorado, June 22-25, 1970. 15 p.

Descriptors: *Cooling Towers, *Design criteria, Cooling, *Thermal Pollution, Heat budget, Evaporation, Environmental effects, Thermal power plants, Nuclear power plants, Heat water purification, Waste water disposal, Corrosion control, Biological properties.
Identifiers: Cooling Tower design.

Major considerations involved in selecting the cooling water system of a large industrial plant are presented in this paper. Cooling tower specifications and testing are reviewed. The paper also presents considerations for the water treatment and waste water disposal of a cooling water system utilizing a tower. Approximately 50% of the heat input to a modern fossil fueled unit is rejected to the cooling water. A nuclear fueled unit rejects about 50% more heat than a fossil fired unit per kw hour. A basic cooling system which is described further has been applied. Some practical experiences with cooling system operating are discussed from the standpoint of process control, process leaks, corrosion, chemical conditioning, blowdown, biological and microbiological problems, etc. (Novotny-Vanderbilt)
W71-02073

CONTROL OF COOLING TOWER MIST,
Celanese Chemical Co., Clarkwood, Tex.
R. H. Maurer.
Cooling Tower Institute, Semi annual Meeting, Snow-at-Aspen, Colorado, June 22-24, 1970. 7 p, 3 fig.

Descriptors: *Cooling towers, Fog, *Thermal pollution, Temperature, Safety, Mist heated water.
Identifiers: Visibility hazard, Exhaust air, Gas burners.

Means of solving a visibility hazard due to mist from cooling towers are described: Possible methods of controlling cooling tower mist emission are (1) installations of electrostatic precipitators on the cooling tower exhaust air, (2) elimination of fog particles by impingement upon wiremesh, (3) by seeding, (4) chemical spraying, (5) by the nylon string fog dispersion method, (6) heating the cooling tower exhaust air with steam heating coils and (7) with natural gas burner. It was found that exhaust re-heat method was the best solution to the problem. Safety from fires is a major concern. The total cooling water circulation rate is 116,000 gpm with 17.9F average temperature difference across the cooling towers which have the mist control facilities. The anticipated maximum natural gas requirement is 16.5 mm SCFD under average fogging condition. (Upadhyaya-Vanderbilt)
W71-02074

ENVIRONMENTAL CONTROL - WATER: MANY GAINS, MUCH TO BE DONE,
For primary bibliographic entry see Field 05G.
W71-02101

DEVELOPMENTS IN WATER QUALITY RESEARCH, PROCEEDINGS OF THE JERUSALEM INTERNATIONAL CONFERENCE ON WATER QUALITY AND POLLUTION RESEARCH, JUNE 1969.
Hebrew Univ., Jerusalem (Israel).
For primary bibliographic entry see Field 05G.
W71-02102

IRRIGATION WITH RECLAIMED WASTEWATER,
Hirsch and Koptionak, San Diego, Calif.
Lawrence Hirsch.
In: Shuval, H. I., editor, Developments in Water Quality Research, Ann Arbor-Humphrey Science Publishers, Ann Arbor, Michigan, 1970, p 251-258. 5 ref, 1 tab, 1 fig.

Descriptors: *Water reuse, Rates, Irrigation efficiency, Nutrient requirements.
Identifiers: *San Diego County, Hershkovitz, Feinmesser, Los Angeles Chamber of Commerce.

Since the projected cost of potable water per acre foot in San Diego County, California is expected to double within ten years, the author stresses the need for 'intensified future utilization of reclaimed waste water.' Although he mentions some of the detrimental chemical and public health factors. he concludes that reclaimed water contains a higher level of plant nutrient value and if 'well-oxidized, non-putrescible and reliably disinfected or filtered' is not harmful to health. In addition, the nitrogen, phosphorus and potassium found in reclaimed water is marketable as fertilizer. (See also W71-02102) (Holmes-Rutgers)
W71-02103

THE OUTLOOK FOR WASTE WATER UTILIZATION IN ISRAEL,
Technion - Israel Inst. of Tech., Haifa. Sanitary Engineering Labs.
Alberto M. Wachs.
In: Shuval, K. T., editor, Developments in Water Quality Research, Ann Arbor-Humphrey Science Publishers, Ann Arbor, Mich., 1970, p 109-123. 12 ref, 5 fig, 2 tab.

Descriptors: *Water reuse, Cost-benefit analysis, Salinity, Nutrient requirements, Oxidation lagoons.
Identifiers: *Dan Region Project for Waste water Reuse, Parkhurst, Stephan, Weinberger.

In Israel, where 85 percent of available natural water resources are already being utilized 'it becomes necessary to use water from natural resources more than once.' The author discusses the construction and costs of the largest waste water reuse project in Israel, namely the Dan Region Project which includes TelAviv and six surrounding municipalities. Since the alternative to waste water reuse is seawater desalination, the author concludes that the former compares favorably with the latter in terms of costs. Although waste water reuse in agriculture is still a costly undertaking, the author believes that the costs of disinfecting sewage may be able to be met by the savings in chemical fertilizers thereby incurred. (See also W71-02102) (Holmes-Rutgers)
W71-02104

COMBINED SEWER CONSIDERATIONS BY PHILADELPHIA,
Philadelphia Water Dept., Pa. Water Pollution Control Div.
Carmen F. Guarino, Joseph V. Radziul, and William L. Greene.
In: Proceedings, American Society of Civil Engineers, Journal of the Sanitary Engineering Division, Vol 96, No SA1, p 1-14, February 1970. 3 fig, 20 ref.

Descriptors: *Sewers, *Pollution abatement, *Methodology, Legislation, Water quality.
Identifiers: *Combined sewers, *Philadelphia, Storm sewers, Sanitary sewers.

City of Philadelphia's experience and study of the combined sewer over-flow pollution problem are described. Water quality legislation and pollution abatement philosophy are considered. The needs for problem definition are delineated along with pertinent constraints of existing methodology and measuring instrumentation. Costs and economic analysis of some abatement schemes are evaluated. Complete separation of stormwater and sanitary wastes, storage in conduit or detention basins, a total systems concept and the microstraining, chlorination, and ozonation of discharges are some of the principles reported for the control and treatment of combined sewer over-flows, or both. Emphasis is directed to the determination of priorities in resolving the overall national pollution problem and the need for a systematic approach. (Davis-Chicago)
W71-02120

5E. Ultimate Disposal of Wastes

DIFFUSION OF HORIZONTAL BUOYANT JET DISCHARGED AT WATER SURFACE,
Tokyo Univ. (Japan).
For primary bibliographic entry see Field 05B.
W71-01790

SEPTIC TANK SYSTEMS,
Brown and Caldwell, San Francisco, Calif.
For primary bibliographic entry see Field 05D.
W71-01842

MARINE EFFLUENTS RESEARCH AND MARINE DISPOSAL OF EFFLUENTS,
For primary bibliographic entry see Field 05D.
W71-01983

MANAGEMENT OF FARM ANIMAL WASTES.
American Society of Agricultural Engineers, St. Joseph, Mich.
For primary bibliographic entry see Field 05D.
W71-01992

PUMPING MANURE SLURRIES,
California Univ., Davis. Dept. of Agricultural Engineering.
S. A. Hart, J. A. Moore, and W. F. Hale.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 34-38. 22 fig, 2 tab, 5 ref. Public Health Research Grant EF-265.

Descriptors: *Pump testing, *Slurries, *Farm wastes, *Waste disposal, *Performance, Waste dilution, Efficiencies, Contrifugal pumps.
Identifiers: Handling, Capacity, Positive displacement, Diaphragm, Input horsepower, Selection criteria.

The purpose of this report was to analyze the performance characteristics of the different kinds of pumps under various conditions. Five pumps, representing centrifugal, positive displacement, and diaphragm types were tested. A pump was always tested with water first. Fresh manure was then mixed with the water to form a slurry. This was kept well mixed both by recirculation by the pump and by continuous mixing of the storage tank. Some 300 individual runs were made in testing the five pumps with three manures at various speeds. Dilution was more important than kind of pump, thin slurries being most satisfactory. Practical and economic conditions are discussed relating to pump selection. (See also W71-01992). (Christenbury-Iowa State)
W71-02000

ENGINEERING PROBLEMS IN YEAR-ROUND DISTRIBUTION OF WASTE WATER,
Pennsylvania State Univ., University Park, Pa. Dept. of Agricultural Engineering.
E. A. Myers.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 38-41. 1 tab, 2 fig, 6 ref.

Descriptors: *Sprinkling, *Distribution systems, *Sewage disposal, Farm wastes, Freezing, Winter, Distribution patterns.
Identifiers: Deflector stationary sprinklers, Year-round irrigation.

This paper presents some of the problems encountered which may be considered in the design, installation, and operation of irrigation systems for animal-waste disposal. The system used to distribute waste water at Penn State is first explained briefly. Then the problems encountered are discussed under the headings: pumping, pipe system, and irrigation heads. (See also W71-02001). (Christenbury-Iowa State)
W71-02001

SLOPING FLOORS FOR BEEF-CATTLE FEEDLOTS,
California Univ., Davis.
For primary bibliographic entry see Field 05D.
W71-02002

CATTLE-MANURE HANDLING AND DISPOSAL SYSTEMS ON THE WEST COAST,
Washington State Univ., Pullman. Dept. of Agricultural Engineering.
E. H. Davis.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 45-47. 3 ref.

Descriptors: Cattle, *Farm wastes, *Farm management, Project planning, Environmental sanitation.
Identifiers: Loafing sheds, Liquid manure, *Health authorities, Alleyways, Holding tanks.

Stall housing, an acceptable practice, produces manure which requires special handling. The method of handling and disposing of manure in a sanitary manner depends on climatic conditions and management practices. Disposal of animal wastes is part of the livestock enterprise and should be charged to this operation. As animals and people get closer together in heavily populated areas, disposal of animal wastes in a sanitary manner becomes increasingly important. Close working relationships with state health departments is essential. Additional research is needed concerning lagoon, nitrate contamination of underground

water supplies, grinding units for processing beef and dairy manures, and agitation equipment for large holding tanks. (See also W71-01992). (Christenbury-Iowa State)
W71-02004

ECONOMIC EVALUATION OF LIQUID-MANURE DISPOSAL FOR CONFINEMENT FINISHING OF HOGS,
Illinois Univ., Urbana. Dept. of Agricultural Economics.
Richard P. Kesler.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 122-125. 6 tab, 2 ref.

Descriptors: *Farm wastes, *Swine, *Disposal, *Economics, *Annual cost, Lagoons, Storage capacity, Size, Nutrients, Ultimate disposal, Liquid wastes.
Identifiers: Manure, Total lagooning, Hauling and spreading, Recovery rate, Fertilizer nutrients, Salvaged nutrients.

Manure is a valuable by-product of the hog industry. This manure must be disposed of on the land to obtain its inherent value. Factors that should be considered in choosing a manure disposal system are (a) amount of manure that is produced, (b) fertility content of the manure and its value as a replacement for commercial fertilizer, (c) disposal costs of each system, and (d) availability of cropland on which to spread the manure. An extensive economic analysis of three disposal systems is presented: (I) Total hauling and spreading, (II) Total lagooning, and (III) Partial hauling and spreading and lagooning. Three sizes of hog operation were considered in the comparison: 500, 1500, and 2500 head. (See also W71-01992) (Christenbury-Iowa State)
W71-02028

FARM WASTE DISPOSAL-AMENITY AND GOOD NEIGHBOURLINESS,
K. B. C. Jones.
Great Britain Ministry of Agriculture, Vol 77, No 4, p 165-167, April 1970.

Descriptors: *Farm wastes, *Odor, *Water pollution, *Building codes.
Identifiers: *Noise, *Nuisances, *Legal action, Solid refuse.

A general picture of waste pollution in England's country-side is shown by comparing today's production and disposal with that of yester-year's. Nuisances that are annoying to both farmers and city-dwellers are described. The rights and liabilities of both farmer and city-dwellers are outlined. (Miner-Iowa State)
W71-02048

5F. Water Treatment and Quality Alteration

PLAQUING AND IMMUNOLOGICAL METHODS FOR DETECTION AND IDENTIFICATION OF ENTEROVIRUSES,
Arizona Univ., Tucson. Dept. of Microbiology and Medical Technology.
For primary bibliographic entry see Field 05A.
W71-01651

A MASTER PLAN REPORT FOR THE ATLANTIC COUNTY NEW JERSEY PLANNING BOARD, WATER AND SEWER STUDIES.
Atlantic County Planning Board, Atlantic City, N.J.
For primary bibliographic entry see Field 05D.
W71-01875

HEALTH ASPECTS AND VECTOR CONTROL ASSOCIATED WITH ANIMAL WASTES,
Public Health Service.
W. M. Decker, and J. H. Steele.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No. SP-0366, Michigan State University, May 1966, p 18-20. 12 ref.

Descriptors: *Farm waste, *Zoonoses, *Salmonella, *Mycobacterium, *Diseases, Water pollution sources, Public health.
Identifiers: *Pathogenic organisms, Brucella, Leptospira.

The diseases contracted by man from animals are discussed. Q fever, Anthrax, Salmonellosis, Tuberculosis, Brucellosis, and Leptospirosis are the major diseases examined. The source of the disease and the means by which man contracts the diseases are presented. Other pathogenic organisms arising from animals are mentioned. (See also W71-01992). (Christenbury-Iowa State)
W71-01995

WATER SUPPLY AND POLLUTION CONTROL PLANS FOR VOLUSIA COUNTY, FLORIDA.
East Central Florida Regional Planning Council, Titusville.
For primary bibliographic entry see Field 05D.
W71-02050

SOFT WATER SUPPLY FOR URBAN CONSUMPTION, A FEASIBILITY STUDY,
Tahal - Water Planning for Israel Ltd., Tel Aviv.
P. Dalinsky.
In: Shuval, K. T., editor, Developments in Water Quality Research, Ann Arbor-Humphrey Science Publishers, Ann Arbor, Mich., 1970, p 79-87. 23 ref, 4 tab, 1 fig.

Descriptors: *Municipal water, Water softening, Expenditures, Economic feasibility, Cost benefit analysis.
Identifiers: *Dan Regional Scheme, American Institute of Laundering, World Health Organization, Holland.

Hard water in Israel causes increased consumer expenditures of soaps and clothes. A comparative economic analysis of three alternative methods of supplying soft water to the 7-city Dan (Tel Aviv) Regional Scheme is presented in this paper. Factors such as savings in soap consumption, reduction in clothes wear-and-tear, savings in salt costs, savings in sewage project investments are included in the feasibility study. The report emphasizes the economic benefits to be derived from the supply of soft water to urban areas. (See also W71-02102) (Holmes-Rutgers)
W71-02106

5G. Water Quality Control

USE OF NEW ANALYTICAL METHODS FOR WATER RESOURCE DEVELOPMENT,
Texas Univ., Austin. Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 06A.
W71-01658

MATHEMATICAL PROGRAMMING FOR REGIONAL WATER QUALITY MANAGEMENT,
California Univ., Los Angeles. Graduate School of Business Administration.
Glenn W. Graves, Andrew B. Whinston, and Gordon B. Hatfield.
Paper copy available from SOD order as: I67.13/4: 16110FPX08/70 Price $1.25 MF. available from NTIS as PB-195 830, Price $0.95. Water Pollution Control Research Series, 16110 FPX 08/70, August, 1970. 123 p, 27 tab, 18 fig, 13 ref, 2 append. FWQA Project 16110 FPX.

Descriptors: *Regional analysis, *Waste water treatment, *River basin development, *Optimum development plans, Estuaries, Simulation, Water quality, Mathematical models, Computer programs, Optimization.
Identifiers: Nonlinear programming, Cost minimization, *Delaware estuary, Algorithms.

An application of a non-linear programming algorithm to the problem of optimal water quality control in an estuary is described. The mathematical model that was developed gives the solution to the general mixed case of at-source treatment, regional treatment plants, and by-pass piping. The non-linear algorithm is developed in considerable detail and a sample problem is worked out. Detailed results are presented for a pilot problem to illustrate the method of solution. Actual data from the Delaware Estuary is used to solve a large scale problem and the solution is given. The results indicate that a regional treatment system for the Delaware Estuary is superior, in terms, of total cost, to other proposed schemes. (Graves-UCLA)
W71-01659

AREAWIDE SEWERAGE MASTER PLAN REPORT FOR THE DENVER METROPOLITAN AREA. PHASE I (INVENTORY).
Denver Regional Council of Governments, Colo.
For primary bibliographic entry see Field 05D.
W71-01687

COMMENTARY IN SOVIET PERIODICALS ON ENVIRONMENTAL POLLUTION,
Joint Publications Research Service, Washington, D.C.
V. S. Vishnyakov.
Translations of: Priroda, No 4: p 93-97, 1966. Available from NTIS as PB-190 788T, $3.00 in paper copy, $0.95 in microfiche. Joint Publications Research Service Trans 36,815, August 3, 1966, various pagings.
Identifiers: *Air pollution, *USSR, *Water pollution, USSR, Wastes (Industrial), Control, Rivers, Aquatic animals, Industries, Purification, Environment, Contamination, *Air pollution control equipment.

One major contributing factor to the Soviet pollution problem is the divergency between parochial economic benefits and wider public interest. The nature of the Soviet system adds to these difficulties. First, those responsible for making economic decisions with consequences for the pollution situation are subject to incentives and penalties designed to make them maximize production. Second, and more important, the regime's priority attachment to the goal of economic growth diminishes the possibility of its acting as an honest arbiter between narrow economic and overall public interests. It would appear from the writings that the USSR has its share of individuals dedicated to the cause of conservation and that, moreover, these people have a chance to be heard. But aside from passing an occasional anti-pollution decree or fining a blatant malefactor now and then, the regime's growth-at-all-costs orientation is never far from the surface. A collection of Soviet articles on environmental pollution problems in USSR are presented.
W71-01688

VOLUNTARY PRIVATE BEHAVIOR AS A MEANS TO REDUCE CONSUMER HEALTH HAZARDS AND ENVIRONMENTAL POLLUTION,
Brookings Institution, Washington, D.C.
Carl W. Bruch.
Available from NTIS as PB-189 389, $3.00 in paper copy, $0.95 in microfiche. Study Report, 1969. 203 p, 172 ref.
Identifiers: *Public health, Hazards, *Management planning, Environment, Air pollution, Water pollution, Wastes (Industrial), Industrial relations, Attitudes, Organizations, Control systems, Voluntary waste control, Pollution control.

The document is concerned with how much reliance the public should place on voluntary private behavior to protect the environment and the consumer and whether the voluntary activities of industry possessed the potential to obtain necessary changes in environmental quality and protection from consumer health hazards. This study examined the nature of the regulatory process as a legal and administrative tool, the role of incentives and economics in pollution control, and a qualitative estimation of achievements of voluntary private behavior in the reduction of direct health hazards associated with foods, drugs, and cosmetics, and the indirect health hazards from air, water and solid waste pollution.
W71-01880

AN ECONOMIC STUDY OF THE EFFECT OF MUNICIPAL SEWER SURCHARGES ON INDUSTRIAL WASTES,
North Carolina Water Resources Research Inst., Raleigh.
Don E. Ethridge.
Available from NTIS as PB-195 981, $3.00 in paper copy, $0.95 in microfiche. Water Resources Research Institute, Report No 41, November 1970. 122 p, 8 tab, 12 fig, 34 ref, 3 append. OWRR A-047-NC (2).

Descriptors: Evaluation, *Costs, Sewers, *Industrial wastes, Poultry, Industrial use (Water), Biochemical oxygen demand, Municipal wastes, Municipal water.
Identifiers: *Sewer surcharges, *Surcharges, *Poultry processing industry, *Beet processing industry.

This study analyzes the industrial response to sewer surcharges (1) in a theoretical framework and (2) using two empirical estimation procedures. The purpose is to develop and appraise alternative methods of studying the response of specific industries. A synthetic or budgeting approach was used to estimate firm's responses for the beet processing and poultry processing industries. It was estimated that a typical beet processing plant would reduce its wasteload discharged by 75 percent if faced with a surcharge of 2 cents per pound of BOD (from 31,600 pounds of BOD (Biochemical Oxygen Demand) per day with no surcharge to 7,770 pounds of BOD per day with a surcharge of 2 cents per pound of BOD). The corresponding estimate for a poultry processing plant was a reduction of 32 percent. It was estimated that the elasticity of total pounds of BOD discharged by beet processing plants with respect to the surcharge on BOD is -.7 at a 'typical' surcharge of approximately 2 cents per pound of BOD. The corresponding elasticity estimate for poultry processing plants was estimated to be -.15. Regression analysis was also used to estimate firms' responses for the poultry processing industry. The resulting estimate of the elasticity of total pounds of BOD discharged with respect to the surcharge was -.23.
W71-01897

WATER QUALITY CONTROL WITH SYNTHETIC POLYMERIC FLOCCULANTS,
Connecticut Univ., Storrs. Inst. of Water Resources.
For primary bibliographic entry see Field 05D.
W71-01899

SEPARATION OF OIL AND WATER WITH GRAVITY SEPARATOR (FRENCH),
Laval Univ., Quebec; and Hydraulic Research Inst., Bratislava (Czechoslovakia).
K. Rohan, and M. Zajdlik.
English synopsis. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2 (Subject B), Science Council of Japan, Kyoto, p 177-189, 1969. 13 p, 6 fig, 2 tab, 5 ref.

Descriptors: *Water pollution, *Groundwater, *Oil wastes, *Separation techniques, Infiltration, Model studies, Mathematics, Equations, Path of pollutants, Foreign projects.
Identifiers: *Hydraulics Laboratory of Bratislava (Czechoslovakia).

This paper gives the test results and computation methods used in the Hydraulics Laboratory of Bratislava, Czechoslovakia, concerning oil and water mixtures with emphasis on protection of groundwater supplies against pollution from oil pentration. Related equations and graphs are included. It is possible to utilize gravity separators because water and oil usually do not create emulsions. (Woodard-USGS)
W71-01930

REMOVAL OF SALINE WATER FROM AQUIFERS,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
E. J. Carlson, and P. F. Enger.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 121-134, 1969. 14 p, 4 fig, 1 tab, 16 ref.

Descriptors: *Saline water-fresh-water interfaces, *Leaching, *Saline water systems, *Groundwater movement, Drainage systems, Hydraulic models, Mathematical models, Aquifers, Model studies, Drainage programs, Subsurface drainage, Water management (applied).
Identifiers: Aquifer sweetening, Aquifer desalination.

Aquifer desalting was studied in a rectangular, glass-walled, sand-filled tank and in a mathematical model. Two types of aquifers were studied: (1) a 1:40 scale, two-part aquifer (course and fine sand) representing a vertical cross section through an idealized portion of an irrigated valley; and (2) a fine sand, single-part aquifer used to evaluate a formula derived from the Ghyben-Herzberg principle for computing depth to a saline-fresh water interface. Salt water was flushed from the aquifers into subsurface drains by applying fresh water to the surface. Test results for both aquifer types showed that tile drains placed near the ground surface will not intercept and discharge surface-applied fresh water if all or part of the aquifer contains salt water. The fresh water displaces the salt water without appreciable mixing and moves it into the drains. A stable fresh-salt water interface is thereby formed in the aquifer. Reduced spacing of drains reduced the amount of salt water that will be removed from the aquifer. Progress of the tests was recorded in still and timed-sequence motion pictures. (Knapp-USGS)
W71-01932

INVESTIGATION OF AXISYMMETRICAL STRATIFIED FLOW TOWARDS A POINT SINK,
Tokyo Inst. of Tech. (Japan); and Japan Atomic Power Co., Tokyo. Civil Engineering Section.
Mikio Hino, and Sotoaki Onishi.
In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2, (Subject B), Science Council of Japan, Kyoto, p 289-296, 1969. 8 p, 3 ref.

Descriptors: *Water resources, *Stratified flow, *Intakes, *Flow characteristics, Water storage, Withdrawal, Model studies, Theoretical analysis, Water quality, Salinity, Mathematics, Equations, Foreign projects.
Identifiers: Japan.

The flow towards an intake riser pipe is theoretically analyzed as an axisymmetrical flow into a point sink. Experiments were carried out in a lucite tank with a bottom shaped in a 1/4 circle, 60 cm deep. At the center of circle, the tank had a cylindrical outlet with a diameter of 6 cm and 25 cm high into which an intake cylinder with a slot was inserted. Several kinds of intake cylinders, each of which has a different location of the slot, were prepared. Various densities of salt water layers were used, and graphs and diagrams relate flow systems and selective withdrawal. (Woodard-USGS)
W71-01960

EFFLUENT FROM A SLOT INTO STAGNANT OR MOVING AMBIENT FLUID OF GREATER DENSITY,
Hydraulics Research Station, Wallingford (England).
Habib O. Anwar.
French summary. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2, (Subject B), Science Council of Japan, Kyoto, p 297-308, 1969. 12 p, 8 fig, 4 ref.

Descriptors: *Density stratification, *Effluents, *Fresh water, *Heavy water, *Model studies, Mathematics, Equations, Stagnant water, Movement, Density, Profiles, Salinity, Vertical migration, Laboratory tests, Foreign projects, Hydraulic properties.
Identifiers: *Ambient fluid, Hydraulics Research Station (Wallingford, England).

Investigations were conducted at the Hydraulics Research Station, Wallingford, England, to determine the effects of vertically discharging fresh water upward into an ambient fluid of greater density. The ambient fluid was a solution of salt water with uniform density, and was either stationary or moving slowly upward. Density profiles were determined by measuring the concentration of the salt solution using an electrical conductivity probe, and were found to be of Gaussian form close to those of a natural convection plume. The nozzle densimetric Froude number, based on the slot width, ranged from 4 to 10. The results of this investigation are related to an effluent discharged from a long diffuser pipe into sea water. The flow at a small distance from the diffuser can be regarded as a flow from a line source with a finite width. Related graphs and equations are included. (Woodard-USGS)
W71-01961

MANAGEMENT OF FARM ANIMAL WASTES.
American Society of Agricultural Engineers, St. Joseph, Mich.
For primary bibliographic entry see Field 05D.
W71-01992

HEAT REJECTION REQUIREMENTS OF THE U. S.,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
For primary bibliographic entry see Field 05C.
W71-02062

CHANGING EMPHASIS IN THE SITING OF STEAM ELECTRIC POWER STATIONS,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 05C.
W71-02063

COMPARISON OF DIFFERENT TYPE COOLING TOWERS FOR GAS TURBINE INLET AIR SERVICE,
West Texas Utilities Co., Abilene.
A. R. Cox.
Cooling Tower Institute, June 22, 1970. 8 p, 3 fig.

Descriptors: Cooling towers, Freezing, Alkalinity, Temperature, Dual system.
Identifiers: Spray-type tower, Gas turbine generators, Compressors, Forced-draft, Wood structure, Topping cycle.

West Texas utilities company has three gas turbine generators and all three units are served by cooling towers to cool and clean the inlet air to the gas turbine compressors, in order to maintain maximum efficiency and capabilities of the units. A combined

cycle arrangement of a 25 mw gas turbine generator with a 100 mw steam turbine generator at San Angelo has proven to be a very efficient arrangement. Operation during cold weather presents a freezing problem in the cooling tower and eliminators. This could result in blockage of the air passages which might damage the cooling tower, the air ducts, or the compressors. An automatic shut down of the circulating water pumps is provided to function at 40F to eliminate the freeze-up hazard. The Rio Pecos gas turbine generator is a 5 mw unit and the inlet air cooling tower is a wood structure, installed in 1954 at a cost of 7,300dollars. Acid is used for alkalinity reduction to hold the basin water pH between 7.0 and 7.5. A brief description and the figures of three cooling towers are shown. (Upadhyaya-Vanderbilt)
W71-02069

THERMAL POLLUTION CONTROL IN BAVARIA,
Bavarian Bureau of Water Supply and Pollution Control, Munich (West Germany).
F. K. Von Ammon.
Proceedings of the 24th Industrial Waste Conference May 6, 7, 8, 1969 Purdue University, p 1357-1360.

Descriptors: *Thermal pollution, Evaporation, Temperature, Self-purification, Cooling water, Reservoirs, Dissolved oxygen, Aeration Analysis.
Identifiers: Water organisms.

The harmful influence of a heat discharge is exerted in three principal ways. These are, evaporation of water, creating a decrease of flow and dilution of other wastes, direct influence of high temperatures on water organisms and reduction of self-purification capacity. For water resources management, there is a need for a simple method of estimating heat load in a certain reach of a river. The next step is to select a permissible maximum temperature in the river. In Bavaria 28C is often used. For the Danube river, which still contains valuable fish and has a lower natural temperature, 25C has been set. Experience has shown that the cooling time often lies in the region of 2-3 days under summer conditions. This means, in an impounded river, that there is the possibility of a power station approximately every 20 km. In several cases, where the receiving water is polluted, the cooling water has to be aerated. (Upadhyaya-Vanderbilt)
W71-02071

CONTROL OF COOLING TOWER MIST,
Celanese Chemical Co., Clarkwood, Tex.
For primary bibliographic entry see Field 05D.
W71-02074

A STEADY STATE OPTIMAL DESIGN OF ARTIFICIAL INDUCED AERATION IN POLLUTED STREAMS BY THE USE OF PONTRYAGIN'S MINIMUM PRINCIPLE,
Rutgers - The State Univ., New Brunswick, N.J.; and Electronic Associates, Inc., Princeton, N.J.
Burton Davidson, and Robert W. Bradshaw.
Water Resources Research, Vol 6, No 2, p 383-397, April 1970. 15 p, 13 fig, 1 tab, 17 ref.

Descriptors: *Optimization, *Pollution abatement, *Steady flow, *Digital computers, *Analog computers, Rivers, Aeration, Systems analysis, Constraints, Dissolved oxygen, Biochemical oxygen demand, Laplaces equation.
Identifiers: Algorithm, Pontryagin's minimum principle, Streeter-Phelps equation.

Optimum control theory based on Pontryagin's minimum principle was applied to the problem of specifying the steady state distribution of artificial aeration in polluted rivers. The optimization was developed for a general integral type cost functional with weighted energy contraints. It was composed of four main parts: (1) the objective function, (2) the performance equations, (3) the optimizing algorithm, and (4) the methods of solution. The system equations used were of the classical Streeter-Phelps genre with an induced aeration term added as the control function. A small highly polluted river in a state of steady flow with a typical Streeter-Phelps dissolved oxygen (DO) sag profile, a first-stage biochemical oxygen demand (BOD) profile, and isothermal conditions was considered. The formulation of the problem yielded the famous Riccati-Kalman structure and an analytical solution. Several optimal and suboptimal aeration designs at different temperature levels were obtained using a digital computer and an automatic plotting routine. An analog computer was used in the critical stages of the numerical solutions. Results from the analog computer pointed the way to the ultimate use of Laplace transform techniques in conjunction with a digital computer for maximum accuracy. The basic understanding of how optimal control theory can be used as a systems tool in the analysis of water quality control problems was furthered. (Kriss-Cornell)
W71-02095

ENVIRONMENTAL CONTROL - WATER: MANY GAINS, MUCH TO BE DONE,
Irvin Schwartz.
Chemical Week, Vol 106, No 24, June 17, 1970, p 90-97. 5 fig, 2 tab.

Descriptors: *Pollution abatement, Waste water treatment, Activated carbon, Thermal pollution, Dissolved oxygen, Biological treatment, Industrial water, Optimum development plans, Institutional constraints, Chemical wastes.
Identifiers: *Federal Water Quality Administration, United States Geologic Survey, Z-M process, Polyelectrolytes.

Chemical processing plants are being required to meet stricter water pollution control standards by the federal government. In order to meet the new standards, chemical companies are experimenting with less polluting methods for disposal, processing and using water. In the meantime, before these new methods are put into practice, several new ideas for biologically treating waste waters have been tried. The most discussed idea is activated carbon adsorption of organic pollutants. This article also lists new products which chemical companies have developed to assist treatment processing of industrial water wastes and urges joint industrial and municipal water waste treatment ventures. (Holmes-Rutgers)
W71-02101

DEVELOPMENTS IN WATER QUALITY RESEARCH, PROCEEDINGS OF THE JERUSALEM INTERNATIONAL CONFERENCE ON WATER QUALITY AND POLLUTION RESEARCH, JUNE 1969.
Hebrew Univ., Jerusalem (Israel).

H. I. Shuval, editor. Ann Arbor-Humphrey Science Publishers, Ann Arbor, Michigan, 1970.

Descriptors: *Water quality control, Waste water treatment, Return flow, Administration, Municipal water.
Identifiers: *Israel's National Water System, Jordan Project, Lake Kinneret, Dan Region Project.

This book is the published proceedings of the Jerusalem International Conference on Water Quality and Pollution Research, held at Hebrew University in June, 1969. The book includes twenty papers, divided into three general subject areas; water quality management, waste water treatment and utilization, and marine pollution. Half of the papers were written by Israeli Scientists and engineers, while the other half were written by South African and United States researchers in these fields. Appropriate portions of the publication are forwarded with abstracts of those portions. (See also W71-02103 thru W71-02106) (Holmes-Rutgers)
W71-02102

WATER QUALITY MANAGEMENT OF THE ISRAEL NATIONAL WATER SYSTEM,
Mekorot Water Company, Tel Aviv (Israel).
Yehuda Goldshmid.
In: Shuval, K. T., editor, Developments in Water Quality Research, Ann Arbor-Humphrey Science Publishers, Ann Arbor, Mich., 1970, p 3-17. 18 ref, 1 fig, 1 tab.

Descriptors: *Water management (Applied), Water quality control, Administration, Water resources development.
Identifiers: *Jordan Project, Lake Kinneret, Israel National Water System.

The construction, operation and management of the Jordan System, the largest single water supply project in Israel, is analyzed in detail in this paper. Although 80 percent of the water pumped through this system was intended for use in agriculture, it was constructed so that all the water could be treated and maintained at drinking-water standards. Therefore, Lake Kinneret, its watershed, the open canal and the reservoirs were viewed as one unit. The author points out however, that although the system has been in operation for five years, a watershed authority has not yet been created, thereby reducing the potential effectiveness. (See also W71-02102) (Holmes-Rutgers)
W71-02105

TOTAL DOLLAR BENEFIT OF WATER POLLUTION CONTROL,
Syracuse Univ., N.Y. Dept. of Civil Engineering.
Nelson L. Nemerow, and Robert C. Faro.
In: Proceedings, American Society of Civil Engineers, Journal of the Sanitary Engineering Division, Vol 96, No SA3, p 665-674, June 1970. 1 fig, 4 tab, 2 ref.

Descriptors: *Water pollution control, *Benefits, *Beneficial use, *Evaluation, Water quality, Costs, Analytic techniques, Cost-benefit analysis, Water utilization, Waste water disposal, Water supply, Land use, Recreation, Waste water treatment.
Identifiers: In-stream water uses, Willingness to pay.

Tangible dollar benefits of a lake or stream at a given water quality may be estimated by determining all uses which both affect and are affected by water quality, by independently valuing each use, and by summing the resultant values. Measurable beneficial water uses related to water quality include recreational uses, withdrawal water uses, wastewater disposal uses, bordering land uses and in-stream water uses. The value of each beneficial use may be estimated by a 'user willingness to pay' criteria or by an evaluation of benefits derived from avoiding payment. Application of this method to Onondaga Lake at Syracuse, New York, produces an estimated net social benefit of $4,400,000 per yr. Recreation proves to be the most important beneficial use for Onondaga Lake at improved water quality and recreational value comprises close to half of the total net annual benefits of decreased pollution. Estimation of tangible dollar benefits of water pollution control may be useful in the decision of the value of installing advanced forms of waste treatment by river basin firms composed of members representing all major groups in water-using society. (Davis-Chicago)
W71-02116

LAKE MICHIGAN DEVELOPMENT PROPOSAL.
Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.

Prepared by the Project in Planning and Design Class, Department of Civil Engineering, The Technological Institue, Northwestern University, Evanston, Illinois, May 1969. 81 p, 9 tab, 32 fig.

Descriptors: *Water quality, *Water supply, *Lake Michigan, *Dike, Earthworkers, Hydraulics, Airport, Water pollution, Bridge construction, Tunnel construction, Highways, Island, Canals, Locks, Costs, Waste dilution, Intakes, Turbidity.

Identifiers: *Lake airport, Artificial island, Sanitary canal, Metropolitan sanitary district, Dike Expressways.

This report presents a proposal for the management of the water quality of Lake Michigan by the construction of a barrier across its southern end. Such a barrier would isolate the largest concentrated area of waste discharges into the lake and prevent further deterioration of the quality of the water in the lake. It would protect the water supplies of the surrounding municipalities by maintaining a consistently high water quality, and would preserve the beaches and shore waters of much of the lake so that Lake Michigan can continue to be a major recreational resource. Three alternative plans are proposed, all of which create a barrier across the lake, but which differ in the extent of development. (See also W71-02157 and W71-02158). (Miller-Chicago)
W71-02156

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

SOIL ASSOCIATIONS AND LAND CLASSIFICATION FOR IRRIGATION, SAN JUAN COUNTY,
New Mexico Agricultural Experiment Station, University Park.
For primary bibliographic entry see Field 03F.
W71-01653

LAND CLASSIFICATION FOR IRRIGATION, CURRY COUNTY,
New Mexico Agricultural Experiment Station, University Park.
For primary bibliographic entry see Field 03F.
W71-01654

USE OF NEW ANALYTICAL METHODS FOR WATER RESOURCE DEVELOPMENT,
Texas Univ., Austin. Dept. of Mechanical Engineering.
C. S. Beightler.
Available from NTIS as PB-195 829, $3.00 in paper copy, $0.95 in microfiche. Water Pollution Control Research Series 16110 FZE 09/70, Sept 1970. 13 p. FWQA Program 16110 FZE.

Descriptors: *River basin development, *Optimum development plans, *Dynamic programming reservoir design, Reservoir sites, Mathematical models, Optimization, Computer programs.
Identifiers: Algorithms.

Studies were made to determine the feasibility of applying recently developed analtyical techniques to the problem of planning for optimal water resource development. An optimal plan with regard to the size and location of proposed reservoirs was taken to be that physical configuration which provided the greatest net economic benefit to the people of the region while meeting future water needs. This research was aimed at providing an improvement over the sub-optimal planning techniques of the past which did not take into account the interacting effects which exist between each reservoir and all downstream reservoirs. These interacting effects are actually the predominant characteristics to be considered in the design of a system of reservoirs in any river basin, and cannot be ignored. For the purpose of formulating a mathematical model for this type of problem, a number of recently developed optimization techniques were studied. The best formulation was found to be that which treated the reservoir system design as a branched multistage decision process. In such processes, the decisions made at each stage (potential reservoir site) affect the circumstances under which all subsequent decisions in the system must be made. The intercoupled staging structure of this process was then exploited by means of the nonserial dynamic programming algorithms developed in the course of this research project. These algorithms are effectively decomposition techniques which break down the nonserial (i.e. branched) process into any equivalent serial process that is amendable to solution through ordinary dynamic programming methods. (Beightler-Texas)
W71-01658

MATHEMATICAL PROGRAMMING FOR REGIONAL WATER QUALITY MANAGEMENT,
California Univ., Los Angeles. Graduate School of Business Administration.
For primary bibliographic entry see Field 05G.
W71-01659

ECONOMICS AND ECOSYSTEMS,
Jon Breslaw.
The Environmental Handbook, Ballantine Book Inc., New York, 1970. p 102-112.

Descriptors: *Environmental effects, *Social aspects, *Natural resources, *Third party effects, Balance of nature, Conservation, Cost-benefit analysis, Environmental ecology, Ecosystem.
Identifiers: *Externalities.

In the American economy the volume of residual waste products is almost as large as the volume of raw materials utilized. The cost system does not make adequate provision for disposing of waste products, which often pollute the ecosystem and harm third parties. Such adverse effects are classes as externalities. Four corrective approaches are possible. The first is to 'internalize' externalities by enlarging the size of economic decision units. The second is to issue government regulations enforceable by law. The third is closely related to the second. It is to apply the law of nuisance. Methods two and three are our main reliance, but they have serious limitations. Method four involves the impositions of monetary sanctions to help preserve the environment. This can be done either by subsidizing desired courses of action, or by charging for socially harmful action. The latter method seems most advantageous. The policy regarding use of our scarce natural resources such as oil, would be greatly changed by application of the above principles. The costing of pollution effects plus reduced birth rates will be essential to preserving our environment. This article is marked by a good grasp of fundamentals and a very clear non-technical exposition. (Whipple-Rutgers)
W71-01750

A PRELIMINARY EVALUATION OF THE THERMAL EFFECTS OF THE BEN FRANKLIN DAM PROJECT ON COLUMBIA RIVER TEMPERATURES BELOW THE HANFORD PLANT,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
For primary bibliographic entry see Field 05C.
W71-02076

DIFCOR - A PROGRAM TO SOLVE NONLINEAR EQUATIONS,
Tennessee Valley Authority, Knoxville.
Roger P. Betson, and Ralph F. Green.
Research Paper No 6, TVA, Div of Water Control Planning, Hydraulic Data Branch, Hydrol Res and Analysis Staff, June 1967. 31 p, 1 tab, 3 append, 3 ref.

Descriptors: *Optimization, *Statistical methods, *Mathematical models, *Computer programs, Regression analysis.
Identifiers: Nonlinear equations, Differential corrections, Principal component analysis.

A Fortran IV program called DIFCOR used to solve nonlinear equations by an optimization procedure termed, 'the method of differential corrections' was described. It was combined with the multivariate statistical technique of 'principal component analysis' used to minimize the sum of squares prediction error and provided a gregression procedure that could be used with virtually any model. With the present dimensions, up to 20 parameters and 300 observations may be analyzed. To use the program package two additional user subroutines were written for each particular problem. The subroutines gave the user considerable latitude in developing mathematical models. The paper documented the program and described what was computed in the user subroutines. (Kriss-Cornell)
W71-02080

OPTIMIZATION BY THE PATTERN SEARCH METHOD,
Tennessee Valley Authority, Knoxville.
Ralph F. Green.
Research Paper No 7, TVA, Div of Water Control Planning, Hydraulic Data Branch, Hydrologic Research and Analysis Staff, Jan 1970. 73 p, 8 fig, 4 tab, 7 ref.

Descriptors: *Optimization, *Mathematical models, *Least squares method, *Computer programs, Linear programming, Hydrologic properties, Rainfall, Flow.
Identifiers: *'Pattern search' method, Response surface, Nonlinear programming.

A method called 'pattern search' which has the ability to reach an optimum solution for a variety of models and data sets was described. It was divised to overcome the inadequacies of earlier methods of optimization and it does so by finding and following a topologic feature of the response surface. The response surface was described as the mapping of the objective function for the range of values of the parameters. A hypothetical response surface was illustrated. The different types of irregularities which adversely affect different optimization techniques for nonlinear models were explained and the 'iterative least squares' technique was discussed. Methods for coping with irregular response surfaces by accelerating the convergence by following a valley to the optimum were listed. Convergence on an acceptable solution is controlled by sensitivity and different types of sensitivity were mentioned. The program described in the report was written in Fortran IV for an IBM System/360 computer. A brief description of the major functions of the main program PATSEAR and its subroutines were given. Illustrations of the various uses of PATSEAR included (1) a linear model used to check the convergence properties of the 'pattern search' technique; (2) two arbitrary objective functions; and (3) two models of hydrologic systems, one a nonlinear function to predict loss from rainfall on a storm-by-storm basis and the other a daily flow prediction model. (Kriss-Cornell)
W71-02081

SYSTEM SIMULATION FOR ANALYSIS AND DESIGN,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
Roy W. Hann, Jr.
Journal of American Water Works Association, Vol 62, No 5, p 279-284, May 1970. 7 p, 7 fig, 14 ref.

Descriptors: *Computer programs, *Hydraulic design, *Systems analysis, Civil engineering, *Programming languages, *Networks, *Simulation analysis, Reservoir operation, Steady flow, Pumps.
Identifiers: HYNET.

Presented in this paper was the basic philosophy and structure of problem oriented languages as they apply to Civil Engineering problem areas in general and the HYNET program in particular which was developed for hydraulic network analysis. The internal structure of HYNET was briefly discussed and the Problem Oriented Language (POL) package, which the author developed to be the heart of a number of problem oriented languages, was presented. The system was imple-

mented on both the IBM 1130 and IBM 360 computers and all system programming was in the Fortran IV computer language so that conversion to other computers was simple. The system described here was primarily the IBM 360 version. The specific capabilities of HYNET were described with regard to 'Usual' network analysis, to pump system balancing and to system simulation under dynamic conditions. The methodology described required the furnishing of reservoir geometry and initial reservoir conditions. An analysis was made via traditional network analysis and the resultant flows considered as steady state flows for some time period. The volumes in the reservoirs were then adjusted accordingly and the resulting new fixed heads between tanks and the new pump heads were calculated. The analysis cycle was then repeated for as many cycles as desired. The commands which were programmed into the present HYNET system were outlined and their use demonstrated in example problems. (Kriss-Cornell)
W71-02082

DESIGN OF A HYDROLOGIC CONDITION SURVEY USING FACTOR ANALYSIS.
For primary bibliographic entry see Field 04D.
W71-02085

OPTIMUM DESIGN OF COMPLEX WATER RESOURCE PROJECTS,
Rand Water Board, Johannesburg (South Africa).
David Stephenson.
Proceedings, American Society of Civil Engineers, Journal of the Hydraulics Division, Vol 96, No HY6, p 1229-1246, June 1970. 18 p, 6 fig, 3 tab, 2 append. 5 ref.

Descriptors: *Optimization, *Linear programming, *Mathematical model, *River basins, Constraints, Hydroelectric plants, Reservoir storage, Water distribution (Applied), Draft-storage curves.
Identifiers: Vaal River, Tugel River, South Africa.

This paper concentrated on direct optimization of complex water resources projects, using linear programming and the principle of decomposition of linear programs. The water resources model was of the Vaal and Tugel River basins in South Africa and illustrated the optimum design of multi-interlinked river basins. Each river basin had a number of possible dam sites, some of which were suitable for generation of hydroelectricity. The supply of water to industrial and irrigation areas was considered and a pattern of development yielding maximum net benefit was compiled. Constraints on irrigable area, reservoir capacities urban water requirements and draft from reservoirs were expressed algebraically for formulating the mathematical model. The set of linear constraints on variables was tabulated together with benefit coefficients and linear programming methods used to optimized the system design. Hydroelectric power plant capacity, reservoir capacities and a water distribution pattern were optimized by use of draft-storage-frequency analysis and the resulting draft-storage curves. (Kriss-Cornell)
W71-02088

A TWO-STEP PROBABILISTIC MODEL OF STORAGE RESERVOIR WITH CORRELATED INPUTS,
Toronto Univ. (Ontario).
For primary bibliographic entry see Field 04A.
W71-02090

AN APPLICATION OF SPATIAL EQUILIBRIUM ANALYSIS TO WATER RESOURCE ALLOCATION,
Guelph Univ. (Ontario); and University of New England, Armidale (Australia).
J. C. Flinn, and J. W. B. Guise.
Water Resources Research, Vol 6, No 2, p 398-409, April 70. 12 p, 8 tab, 30 ref.

Descriptors: *Mathematical models, *Equilibrium, *Water allocation (Policy), *Pricing, *River basin, *Optimization, Economics, Physical properties, Water demand, Social needs.
Identifiers: Quadiatic programming model.

The interregional equilibrium models developed by Takayama and Judge may be adapted to determine the efficient allocation and pricing of water in a river basin. The model assumed that a river basin authority acts as the sole public utility distributor of water over time and that the capacity to supply water within any time period may be constrained by the physical structure of the system. The physical structure of a hypothetical river basin was depicted and it was assumed that five regions competed for water stored in a headworks reservoir. The price policy sought for the river basin was that which maximized social welfare in relation to the regulated water supplies. Such a criterion is complex and therefore Marshallion concepts of consumer and producer surplus as an economic approximation to social welfare was used to simplify the approach. Two different types of information were required to test the proposed quadratic programming model; economic data and physical data. Data used pertained to water demand schedules, agricultural, industrial and urban demand for water, assumed transfer and processing costs, and physical characteristics of the water delivery system. Estimated water prices, which maximize social welfare in relation to the water supply to all regions for the four seasons of the year, were listed as well as the quantities of water allocated to each region over the year. Limitations and implications for research from this model were discussed. (Kriss-Cornell)
W71-02091

A STEADY STATE OPTIMAL DESIGN OF ARTIFICIAL INDUCED AERATION IN POLLUTED STREAMS BY THE USE OF PONTRYAGIN'S MINIMUM PRINCIPLE,
Rutgers - The State Univ., New Brunswick, N.J.; and Electronic Associates, Inc., Princeton, N.J.
For primary bibliographic entry see Field 05G.
W71-02095

STOCHASTIC IRRIGATION PLANNING MODELS,
Harvard Univ., Cambridge, Mass. Center for Population Studies.
Douglas V. Smith.
A report to the East Pakistan Land and Water Study, Center for Population Studies, Harvard Univ, Jan 1970. 153 p, 19 fig, 24 tab, 115 ref, 5 append.

Descriptors: *Optimization, *Stochastic processes, *Linear programming, *Mathematical models, *Planning, Irrigation design, Economics, Physical properties, Hydrology, Water allocation (Policy).
Identifiers: Algorithm, East Pakistan.

A series of models and solutions algorithms that considered land and water allocation under stochastic economic and hydrologic conditions were developed. The basic deterministic model emphasizing the interactive consequences of the water demands of potential irrigated lands and the alternative water control possibilities that are present in most situations were discussed. Cropping patterns were selected by the model as well as economic implications of water-balance components which figured prominently in the model's formulation. The basic model was solved using a linear programming algorithm, and post-optimality analysis was performed. Stochastic parameters were introduced into the model and general distribution functions, variable capacities, pricewise linear decision rules, and stochastic demands and supplies were constraints dealt with. A sequence of models was constructed and solved with general conditions in mind and with East Pakistan conditions in mind. The first was deterministic, as a set of decisions for initial investment and yearly operations were determined using exante information. The second employed decision rules expressing canal diversions and well pumpages as linear functions. The final model considered streamflow and precipitation to be stochastic and well pumpages and canal diversions to be responsive to available streamflow as well as to irrigation water requirements. Some suggestions for further research were given. (Kriss-Cornell)
W71-02096

THE ALLOCATION AND PRICING OF WATER IN A RIVER BASIN,
Guelph Univ. (Ontario); and University of New England, Armidale (Australia).
For primary bibliographic entry see Field 06C.
W71-02107

MATHEMATICAL MODELS OF LOCATION: A REVIEW,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
David H. Marks, Charles S. ReVelle, and John C. Liebman.
In: Proceedings, American Society of Civil Engineers, Journal of the Urban Planning and Development Division, Vol 96, No UP1, p 81-93, March 1970. 17 ref.

Descriptors: *Mathematical models, *Model studies, *Analytic techniques, Systems analysis, Operations research, Land use, Planning, Methodology.
Identifiers: *Models of location, Private sector models, Public sector models.

Recent models of location are drawn together and compared as to structure, criteria, and constraints. Private sector models are distinguished as those in which the total cost of transport and facilities is isolated as the objective to be minimized. The solution techniques of six such models are presented. Public sector models are characterized by a criterion function involving a surrogate for social utility and by a constraint on investment in facilities or on the number of facilities. Five models with this format are described and compared. The two types of program, location in the private sector and location in the public sector, are seen to have the same conceptual foundation, but have formats which necessarily differ due to the inability to relate social utility to dollar value. (Miller-Chicago)
W71-02111

CHAPTER III: SYSTEMS ANALYSIS, A SUBSTITUTE FOR PLANNING.
For primary bibliographic entry see Field 06B.
W71-02123

SYSTEMS ANALYST'S VIEW OF NOISE AND URBAN PLANNING,
Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
Martin Wachs, and Joseph L. Schoffer.
Journal of the Urban Planning and Development Division, Proceeding of the ASCE, Vol 96, No UP2, p 147-159, October 1970. 1 fig, 9 ref.

Descriptors: *Systems analysis, *Analytic techniques, *Planning, City planning, Methodology.
Identifiers: *Noise.

The problem of noise in urban areas is amendable to solution by the control of locational activities or by technological solutions located at the source of noise, at the receiver, or between the source and receiver. Some basic concepts of systems analysis may be used to determine informational requirements to make planning with respect to noise more realistic and more effective. These techniques can be applied to metropolitan water resources management as well. (Davis-Chicago)
W71-02145

SECTION II: WATER QUALITY AND HYDRAULICS.

In: Lake Michigan Development Proposal, Prepared by Project in Planning and Design Class, Department of Civil Engineering, The Technological Institute, Northwestern University, Evanston, Illinois, May 1969, p 4-33. 8 fig, 7 tab.

Descriptors: *Water quality, *Dike, *Sewage, Management, Waste dilution, Treatment, Cities, Intakes, Turbidity, Filtration, Algae.
Identifiers: *Sanitary canal, Metropolitan sanitary district.

The management of the water quality of the lake is looked upon as a complex problem, which can be approached in a number of ways. The emphasis in this part is on the construction of a dike or barrier to isolate the badly polluted southern portion of the lake with discussion of the present pollution problem, the benefits to be accrued with a barrier, construction factors, and the variety of ways it could utilized by the public and private sectors. Also investigated are the possible interrelationships with a proposed new airport on the lake, the Metropolitan Sanitary District, and relationships with urban and industrial areas in Northern Indiana. (See also W71-02156). (Miller-Chicago)
W71-02157

SECTION III: ALTERNATIVE PLANS.

In: Lake Michigan Development Proposal, Prepared by Project in Planning and Design Class, Department of Civil Engineering, The Technological Institute, Northwestern University, Evanston, Illinois, May 1969, p 34-82. 2 tab, 24 fig.

Descriptors: *Water quality, *Hydraulics, *Dike, *Construction materials, *Costs, Lake beds, Supply, Airport, Navigation, Harbors, Recreation, Lake Michigan, Tunneling, Bridges, Solid waste, Islands.
Identifiers: *Lake airport, *Dike expressway, Mass transportation, Monrail.

In this section three alternative plans are discussed, all of which provide a dike for managing the water quality of the lake and which will also provide a large Illinois-Indiana harbor area. These three alternatives present varying degrees of additional benefits and an opportunity for stage construction. The three alternatives are: (1) A minimum dike section; (2) a causeway wide enough to accommodate a highway and rapid transit facilities; and (3) two large islands approximately one-half mile wide at their greatest width. Also, discussed are features typical to all alternatives. The section ends with an over-all summary of the proposal in general. (See also W71-02156). (Miller-Chicago)
W71-02158

6B. Evaluation Process

AN ECONOMIC REAPPRAISAL OF THE TOLEDO BEND MULTIPLE-PURPOSE PROJECT,
Louisiana Water Resources Research Inst., Baton Rouge.
L. H. Falk, and W. J. Stober.
Available from NTIS as PB-195 825, $3.00 in paper copy, $0.95 in microfiche. Louisiana Water Resources Research Institute, Bulletin No 7, Oct 1970. 36 p, 6 tab, 16 ref. OWRR Project A-012-LA (2).

Descriptors: *Cost-benefit analysis, *Multiple-purpose projects, Interstate compacts, Resource allocation, Financing, Hydroelectric power, Taxes, Economics.
Identifiers: *Toledo Bend Reservoir, *Louisiana, *Texas, State taxes, Federal income tax.

Two of the outputs of the Toledo Bend Dam and Reservoir of Louisiana and Texas--hydroelectric power and water supply--could be provided in the private sector. The private costs avoided, therefore, constitute the basic benefits for comparison with the costs of these functions to ascertain economic feasibility. This study examines only the hydroelectric power aspect of the multiple-purpose project. The cost estimates, but not the methods, of the original feasibility study have been used in re-examining project benefits and costs. Benefit-cost ratios are computed from three view-points: (1) that of the power companies purchasing the Toledo Bend output, (2) that of the two states which build the project, and (3) that of the nation as a whole. It is concluded that direct power benefits justify the costs reasonably allocated to power from the standpoint of the power companies and the two states. From the national standpoint, however, the power phase of the project appears unjustified. The bias favoring construction by local interests is a consequence of their ability to shift a portion of the costs to the nation as a whole. The explanation is found in the tax structures and in disparities among discount rates.
W71-01652

SOIL ASSOCIATIONS AND LAND CLASSIFICATION FOR IRRIGATION, SAN JUAN COUNTY,
New Mexico Agricultural Experiment Station, University Park.
For primary bibliographic entry see Field 03F.
W71-01653

LAND CLASSIFICATION FOR IRRIGATION, CURRY COUNTY,
New Mexico Agricultural Experiment Station, University Park.
For primary bibliographic entry see Field 03F.
W71-01654

AREAWIDE SEWERAGE MASTER PLAN REPORT: PHASE I - INVENTORY SUMMARY REPORT.
Denver Regional Council of Governments, Colo.
For primary bibliographic entry see Field 05D.
W71-01679

THE RELATIONSHIP BETWEEN LAND VALUES AND FLOOD RISK IN THE WABASH RIVER BASIN.
Army Engineer Inst. for Water Resources, Alexandria, Va.

Available from NTIS as AD-704 717, $3.00 in paper copy, $0.95 in microfiche. Army Engineer Institute for Water Resources, I WR Report 69-4, December 1969. 117 p.
Identifiers: *Rivers, Floods, *Floods, Economics, Terrain, Production, Agriculture, Protection, Costs, Data processing systems, Selection, Regression analysis, Mathematical models, Programming (Computers), Indiana, Illinois, Ohio, Maps, *Flood risk, Land reclamation, Flood plains, Agricultural economics, *Wabash River, *Flood control.

The report examines the usefulness of using the differential in the value of land of similar productive characteristics on the flood plain and in the upland areas as a measure of the benefits accruing from the provision of flood protection to agricultural areas. A theoretical model is produced and applied to two reaches of the Wabash River and one reach of the White River. The three reaches represent three different topological and flood plain width combinations. The results of the land-value approach are compared with benefit estimates prepared previously using synthetic hydrology. The results of the analysis indicate that while the land-value approach cannot be universally applied there is a considerable range of topological conditions under which the approach offers a viable alternative to current procedures.
W71-01686

COMMENTARY IN SOVIET PERIODICALS ON ENVIRONMENTAL POLLUTION,
Joint Publications Research Service, Washington, D.C.
For primary bibliographic entry see Field 05G.
W71-01688

PLAN FOR PUBLIC SEWERAGE FACILITY DEVELOPMENT.
Rhode Island Statewide Comprehensive Transportation and Land Use Planning Program, Providence.
For primary bibliographic entry see Field 05D.
W71-01700

URBAN HYDROLOGY,
Bauer Engineering, Inc., Chicago, Ill.
For primary bibliographic entry see Field 04C.
W71-01822

NATURAL RESOURCES IN THE COMMONWEALTH OF VIRGINIA,
Rural Affairs Study Commission, Richmond, Va.
For primary bibliographic entry see Field 03B.
W71-01878

SUMMARY OF NATURAL RESOURCES IN THE COMMONWEALTH OF VIRGINIA.
Rural Affairs Study Commission, Richmond, Va.
For primary bibliographic entry see Field 03B.
W71-01879

VOLUNTARY PRIVATE BEHAVIOR AS A MEANS TO REDUCE CONSUMER HEALTH HAZARDS AND ENVIRONMENTAL POLLUTION,
Brookings Institution, Washington, D.C.
For primary bibliographic entry see Field 05G.
W71-01880

WATER SUPPLY AND POLLUTION CONTROL PLANS FOR VOLUSIA COUNTY, FLORIDA.
East Central Florida Regional Planning Council, Titusville.
For primary bibliographic entry see Field 05D.
W71-02050

A PRELIMINARY STUDY OF THE COST OF TUNNEL CONSTRUCTION,
Road Research Lab., Crowthorne (England).
For primary bibliographic entry see Field 08A.
W71-02053

COST-EFFECTIVENESS ANALYSIS OF CIVIL ENGINEERING SYSTEMS: NEW YORK CITY'S PRIMARY,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
Richard de Neufville.
Massachusetts Institute of Technology, Dep of Civil Eng, April 1970. 26 p, 6 fig, 1 tab, 16 ref.

Descriptors: *Cost-benefit analysis, *Water supply, *Civil engineering, Planning, Design, Public Utilities.

A methodology for cost-effectiveness studies of civil engineering was proposed and illustrated by an example of its application to an urban systems problem. The approached tried to bridge the dichotomy of objectives which often exists between the policy levels of government and the engineering agencies, and which leads to frequent impasses for implementation. This five-stage analysis process attempted to broaden the traditional terms of reference for the design of public works, which are usually governed by engineering standards only tenuously related to the multiple objectives of a facility. A procedure was suggested for the generation of alternative configurations of the system and its components. A means was presented for the ex-

ploration of alternative time-phased strategies of development. A case study of the application of this approach to the planning and design of New York City's Third City Water Supply Tunnel was presented and its lessons were discussed. (Kriss-Cornell)
W71-02083

AN APPLICATION OF SPATIAL EQUILIBRIUM ANALYSIS TO WATER RESOURCE ALLOCATION,
Guelph Univ. (Ontario); and University of New England, Armidale (Australia).
For primary bibliographic entry see Field 06A.
W71-02091

SOFT WATER SUPPLY FOR URBAN CONSUMPTION, A FEASIBILITY STUDY,
Tahal - Water Planning for Israel Ltd., Tel Aviv.
For primary bibliographic entry see Field 05F.
W71-02106

TOTAL DOLLAR BENEFIT OF WATER POLLUTION CONTROL,
Syracuse Univ., N.Y. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05G.
W71-02116

CHAPTER II: PREPARATION OF REGIONAL, BASIN AND STATE PLANS,
William Whipple, Jr., Ernest A. Englebert, and Warren L. Trock.
In: Evaluation Processes in Water Resources Planning, Urbana, American Water Association, June 14-19, 1970, p 11-25. 17 p, 5 fig, 3 tab.

Descriptors: *Regional development, *Model, *Planning, *State governments, Landscape, Resources, Hydrology, Analysis, Dynamics, Research facilities, Systems, Water resources, Environment, River basin.
Identifiers: *Regional plans, *Basin plans, *State plans, *Devices, *Needs, *Dynamic optimizing models, *Environmental quality, *Regional development, National efficiency, Biological stress analysis, Stress dynamics, System stimulation, Landscape classification system, Landscape values.

In water resources planning, there is a wide range of objectives and alternatives, but practical limitations narrow relations to a few choices. In the North Atlantic Region, consistent with the guidelines issued by the Water Resources Council, three objectives were selected: (1) environmental quality, (2) regional development, and (3) national efficiency. The three objectives could be considered components of practically all the objectives that could reasonably be postulated and three plans can be used to form the basis of a mixed objective plan. Plan formulation is the relating of three components: (1) the needs, (2) the resources, and (3) the devices, which bridge the gap between needs and resources. Two studies are mentioned because of their innovative nature. One is a study of urban growth by the Regional Plans Association of New York, the other deals with visual and cultural values and was conducted by the Research, Planning and Design Associates of Amherst, Massachusetts. The comprehensive State Water Plan for Nebraska is discussed as an example of the types of activities the States, generally, have been encouraged to undertake. Next, the preparation of regional plans is taken up with emphasis on types of research required. Then preparation of State plans is considered with a discussion of the roles of states, and the question of whether or not the conception and practice of planning is truly comprehensive. Following this is a discussion of dynamic optimizing models for comprehensive river basin planning, including state of the art and direction for research. (See also W70-09369) (Miller-Chicago)
W71-02122

CHAPTER III: SYSTEMS ANALYSIS, A SUBSTITUTE FOR PLANNING.

In: Evaluation Processes in Water Resources Planning, Urbana, Illinois: American Water Resources Association, June 14-19, 1970, p 26-40. 15 p, 1 tab.

Descriptors: *Systems analysis, *Planning, *Great Lakes, *Water quality, Limnology, Model, Water resources, Regression analysis, Benefit, State government, Linear programming, Simulation, Optimization.
Identifiers: *Multiple objective problems.

Presently there are several definitions and overlaps in terminology when discussing systems analysis. Here it is defined as a general concept involving the study of a specified portion of the universe. Historically, it had its beginnings in 1953 in water resources. Currently there are three approaches to measure benefits in multiple objective problems: (1) In the table of National Objective Accounts in Water Resources Council's 'Blue Book,' a table emphasizes the comparison of alternative plans in terms of their multiple objective effects; (2) represented by multiple-objective feasible solutions using a transformation curve with different forms of net benefits; together with social indifference (preference) curves; and (3) the depiction of the parties who gain and lose from different project alternatives including all of the significantly affected groups. There are problems in both the application of systems analysis to certain problems and the technique not being used to its greatest effectiveness in water resources planning. Also, there is a gap between the techniques and those who might make use of it. In terms of objectives and restraints in water resource planning, one can contrast what systems analysis can constitute with the actual nature of the water resources problem. Studies in the Great Lakes are given as examples of modeling techniques in water quality problems. Taken up next is systems analysis in State water problems, and some problems of systems analysis in water quality management. Communities want to incorporate environmental quality and efficiency objectives into planning and operations, when there is assurance of benefit to them and means, politically and institutionally, to accomplish this goal. (See also W70-09369) (Miller-Chicago)
W71-02123

CHAPTER IV: OPTIMUM INVESTMENT IN WATER POLLUTION CONTROL.

In: Evaluation Processes in Water Resources Planning (Urbana, Illinois: American Water Resources Association), June 14-19, 1970, p 41-56. 17 p.

Descriptors: *Investment, *Control, *Pollution abatement, *Optimization, Bioassy, Economic feasibility, Social aspects, Analysis, Systems analysis, Biochemical oxygen demand, Model, Conservation, Simulation, Basin, Cost, Federal project policy, Planning, Cities, State governments, Regional analysis, Leadership, Water quality, Effluents, Evaluation.
Identifiers: *Optimum investment, *Gaming, *Simulation gaming, Chicago.

The chapter includes (1) meaning of optimum, (2) our ability to describe and predict physical, chemical and biological effects of pollution control actions, (3) social and economic objectives and constraints, and (4) implementation of solutions. The major question in preplanning is the purpose of river objectives and water's role in social, industrial and economic development. The intangible nature of some objectives makes formal optimization difficult. Modeling data requirements far outstrip data availability and needs adequate monitoring. Systems analysis and computer techniques provide powerful insights into how to analyze optimum investment problems. Applying these techniques meaningfully, capable of providing viable solutions, requires studies into how consumers perceive pollution, plus determining their objectives for a nonmarket collective good. Regional water quality control programs on paper appear more economically efficient than local programs and plants; but most regional programs are not politically acceptable. Then sub-optimum solutions need to be implemented. As to research needs, more questions were generated than answered. Simulation gaming presents a new technique for evaluating political and social values necessary to describe the objectives and constraints for optimization plus devising institutions to implement optimum investment programs. Operational evaluation procedures for determining improved water quality values for instream uses are needed to provide economic inputs for an objective function necessary for optimization analyses and to give the public a quantification of what it receives from investment. (See also W70-09269) (Miller-Chicago)
W71-02134

CHAPTER V, FLOOD PLAIN MANAGEMENT AND FLOOD INSURANCE.

In: Evaluation Processes in Water Resources Planning (Urbana, Illinois: American Water Resources Association), June 14-19, 1970, p 57-73. 17 p, 2 tab, 1 fig.

Descriptors: *Flood insurance, *Flood plains, *Floods, Planning, Zoning, Cities, State government, Federal government, Floodways, Flood protection, Flood proofing.
Identifiers: *Flood plain management, *Flood plain regulation, Actuarial rate.

Site damage may outweigh economic advantages in developing flood plains. Well being and hazard to life must be incorporated into evaluations with environmental considerations. Regulations of flood plains appear to be accepted by government, by contractors, and considered within the urban framework. When done so, management opportunities expand giving rise to possible synergistic effects. Dealing with a flood plain, there are three approaches (1) flood protection, (2) flood plain regulations, and (3) resource planning. An example of insurance encouraging wise use of flood plains, by 31 May 1970 about 150 communities agreed to adopt land use and control measures, to be eligible for federally assisted flood insurance. Insurance promotes control, since rates decrease with installation of control works. The Federal Flood Insurance Program to 31 May 1970, declared 64 communities eligible. By June, 1970, another 100 were to be covered. Flood insurance studies as a basis for actuarial rates are complete for 25 areas. The 1953 Tennessee Valley Authority program for assisting communities in planning for flood damage abatement serves as a model. The new flood insurance program could begin with technological accuracy, but it is not being exploited. Subsidizing on a percentage basis could overcome excessive and unequal subsidies. There is unequal community treatment. In most Tennessee Valley communities small business flood insurance is not available and is a far more serious need than residential insurance. Zoning and insurance may be effective in regard to additional flood plain investment, but offer little to encourage change in existing situations. (See also W70-09369) (Miller-Chicago)
W71-02135

CHAPTER VI: SPECIAL PROBLEMS OF METROPOLITAN WATER RESOURCES ANALYSIS.

In: Evaluation Processes in Water Resources Planning (Urbana, Illinois: American Water Resources Association), June 14-19, p 74-88, 1970. 21 p, 5 fig.

Descriptors: *Metropolitan studies, *Resources, *Analytical techniques, *Return flow, Simulation, Model, Basin.
Identifiers: *Metropolitan water resources management, *Rural water resources management,

*Water as an organizing concept, Muskegon, Michigan.

As attention is focused on metropolitan areas there is a need to develop clear and workable distinctions between metropolitan water resource management and regional or rural water resource management. Then definitions, concenpts, and characteristics of metropolitan resource management are discussed. Considered next is water as an organizing concept. The disadvantages of single-purpose strategies and the power of complex management strategies are compared. In terms of a metropolitan waste management system, there has been a lag in new technology implementation of as much as 50 years between development and widespread application. The Muskegon County, Michigan, wastewater management plan is used as a case example to present methodology for implementing new wastewater management technology in a metropolitan area. An important feature of the Muskegon plan was the community involvement and education program. Water here served as an organizing concept to a great advantage. Taken up next is wastewater irrigation planned through computer simulation. Then water resources planning in urban-metropolitan areas and recommendations for further research are discussed. (See also W70-09369) (Miller-Chicago)
W71-02136

CHAPTER VII: POLITICAL AND INSTITUTIONAL ASPECTS OF THE EVALUATION OF WATER RESOURCE PROGRAMS.

In: Evaluation Processes in Water Resources Planning (Urbana, Illinois: American Water Resources Association), June 14-19, 1970, p 89-100. 11 p.

Descriptors: *Water resources, *Evaluation, *Political aspects, *Institutions, *Decision making, Shores, Legislation.
Identifiers: *Water institutions, *Public actions.

Program evaluation for water resources planning purposes may be defined as the development and weighing of information that bears on the choice among alternative programs. Water institutions were divided into two broad categories: (1) the set of governmental regulations, laws, policies, and programs, influencing the evaluation process of private enterprise; (2) public agencies providing water services, laws, regulations, etc., determining the behavior of these organizations. Attention is focused on private decision making related to shorelands. Most shorelands are privately owned. As a result, the decisions of private entities have an important bearing upon the benefits society derives from its water resources; and, under existing institutional arrangements, shoreland cannot serve the interest of the public. This idea is considered in hypothetical form. Then, in a similar manner, municipalities are considered; and the possibility of governmental intervention to correct deficiencies. Considered next are alternatives for public action. Recommendations for a substantial variety of research are made. Also, noted is the need for further examination of the techniques of cost sharing so as to develop methods of implementing more equitable cost sharing arrangements. (See also W70-09369) (Miller-Chicago)
W71-02137

CHAPTER VIII, MULTIPLE-OBJECTIVE PLANNING, BENEFIT-COST ANALYSIS AND DISCOUNT RATE.

In: Evaluation Processes in Water Resources Planning (Urbana, Illinois: American Water Resources Association), June 14-19, 1970, p 101-118. 20 p, 2 fig.

Descriptors: *Planning, *Cost-benefit analysis, *Discount rate, *National income, *Income analysis, *Interest rate, Basin, Evaluation, Federal government, Environmental effects, Social aspects, Population, Public health, Benefits, Costs, Cost repayment.
Identifiers: *Multiple objective planning, *National economic development, *National income analysis, Task force, Regional development.

Plans for the use of the Nation's land and water resources should be directed to solutions of existing or projected resource needs or problems as identified by the desires of people in such a manner that optimal contributions would be made to society's preferences for national economic development, environmental quality, social well-being, and regional development. Also, the objectives are listed. Then discussion centers on benefits and costs; plan formation, and a proposed procedure for multiple objective planning. The national income concept of benefit-cost analysis is discussed and it is brought out that it provides a valuable service in separating out the components of benefits and costs in the national income framework. Following the discussion of discount rate and interest rate, attention turned to such topics as reimbursement policy; the question of multiple objectives in an economy in which there is a widespread and official commitment to economic growth; and the question of the identification and classification of environmental quality areas. (See also W70-09369) (Miller-Chicago)
W71-02138

CHAPTER IX, EVALUATION OF ENVIRONMENTAL AND REGIONAL EFFECTS.

In: Evaluation Processes in Water Resources Planning (Urbana, Illinois: American Water Resources Association), June 14-19, 1970, p 119-134. 16 p.

Descriptors: *Evaluation, *Environmental effects, *Regional analysis, *Water resources development, *Economic impact, *Surplus water, Planning, Input-output analysis, Preservation, Landscaping, Water resources, Water management, Project planning.
Identifiers: *Environmental quality, Inter-regional competition, Environmental values, Cultural qualities-resources, Visual qualities-resources, Protection needs, Development needs, Wilderness, Ecological research, Environmental quantification, Esthetic classification.

Water resource investments vary in their ability to affect the levels and mix of economic activity and the income results of that economic activity in the investment region and elsewhere in the Nation. An immediate challenge is the level of our understanding of these effects. Distribution of the effects of investments within the region of the investment and between it and elsewhere is more amenable to analysis than past inclusion of such analysis in evaluation reports would indicate. Choice of region and the character of participation in the process by those groups concerned with regional effects would seem to be crucial to the development of acceptable estimates of effects. Evaluation of environmental effects is not as clear as regional effects. Planners need to know who cares about which environmental values and how they will influence the investment decision process. There is a lack of correspondence between the time frame for evaluation of biological systems and the engineering and economic values more familiar to planners. There is a lack of study of methodology. The intergroup conflict process of decision making does not leave the environmental issue to the technician within the agencies. Should water planners seek out and help organize environmentally concerned groups to help plan. New areas of research are needed, especially in regard to the decision making process and esthetic classification and environmental quantification. Discussion of priority areas of research on regional effects was covered last. (See also W70-09369) (Miller-Chicago)
W71-02139

CHAPTER X, DEVELOPMENT OF A RESEARCH PROGRAM ON THE EVALUATION PROCESS.

In: Evaluation Processes in Water Resources Planning Urbana, Illinois: American Water Resources Association, June 14-19, 1970, p 135-150. 16 p.

Descriptors: *Analytical techniques, *Evaluation, Planning, Water resources, Water development, Social needs, Population, Resource allocation, Cost-benefit analysis, Social aspects, Urban sociology.

The political and social climate for water resources planning and development has dramatically changed within the past five years. The Nation is undergoing a reassessment and recordering of national priorities, causing proposed schemes of water utilization and development to be more critically measured relative to other national needs. Based on the shift of political power from rural to urban areas, there has been a shift from resource-oriented water program to population-oriented water programs. The general dissatisfaction with water evaluation processes, particularly cost-benefit analysis, has led to the formation of new government agencies and reformation of others. The technical valuation process for water resources has become a burning political-social issue. The water resource evaluation process is characterized next, and it is indicated that conceptual outlooks, planning, and evaluation approach are substantially altered. Water planning development needs to be placed in a broader societal context so that new policies and strategies can be effective. Water can be an organizing vehicle together with other public functions, such as transportation, for real integration and change. The changes necessary are then discussed. The changes disciplines be brought into the water evaluation process, particual from the behavioral sciences. Then the research needs in the area of water resources evaluation are discussed in terms of objectives, institutions, and market effects. (See also W70-09369) (Miller-Chicago)
W71-02140

COMPUTERS IN FLOOD CONTROL PLANNING,
Kentucky Univ., Lexington. Dept. of Civil Engineering.
L. Douglas James.
Proceedings, American Society of Civil Engineers, Journal of the Hydraulics Division, Vol 95, No. HY5, p 1859-1869, November 1969. 13 ref.

Descriptors: *Flood control, *Planning, *Computers, Optimization, Evaluation, Non-structural alternatives, Analytic techniques, Computer programs, Channel improvement, Land use, Floodproofing.
Identifiers: *Flood control planning, Structural alternatives.

Federal agencies are required to seek the optimum combination of structural and nonstructural measures for flood control. Most procedures for systematic evaluation of all alternative combinations of structural and nonstructural measures are not feasible under current financial and manpower limitations. The only solution for complete evaluation is by means of the digital computer. Two flood control planning computer programs have been developed which select the optimum combination of channel improvement, flood proofing, and land use management by location within the flood plain and by time. The second program adds detention storage to the list of available alternatives. Both incorporate the entire planning process from the raw data to a selected optimum program of measure use in one run. The programs have been applied to several flood hazard areas in California and Kentucky. (Davis-Chicago)
W71-02141

BASIC CONTEMPORARY URBAN PROBLEMS,
Illinois State Div. of Highways, Springfield.

Felipe V. Derteano.
Journal of the Urban Planning and Development Division, Proceedings of the ASCE, Vol 96, No UP2, p 133-145, October 1970. 13 ref.

Descriptors: *Planning, *Urbanization, *Social aspects, Aesthetics, Ethics, Cities, Community development, Urban sociology, Political aspects, Environment.
Identifiers: *Urban problems.

Urban developments have reached a state that calls for all enlightened persons to take a view, not as passive members of a society that evolves without their particaption, but as interested parties to the actual evolution. What is being observed in the political field has even more significant meanings in the social structure that man has created to lodge his culture. Society is changing, and when this occurs with the intervention of governments at different levels, it is time to see that fate, as never before in history, is in the peoples' hands. Governments are acting; but unless they be better-guided, may end in some complicated and inefficient bureaucratic scheme. Conversely, without aims, society will wind up the target of huge corporations bent only on making large profits in new ventures with government financing. Yet, people must intelligently surrender a misguided individualism and look for more social cohesion, if society is to remain as is. (Davis-Chicago)
W71-02144

PLANNING STANDARDS FOR STORM DRAINAGE,
Kansas City Public Works, Mo.
For primary bibliographic entry see Field 04A.
W71-02146

STATE FLOOD-PLAIN MANAGEMENT ACTIVITIES,
Oregon State Water Resources Board, Salem.
Jack G. Johnson.
Journal of the Hydraulics Division, ASCE, Vol 96, No HY10, Proc paper 7589, p 2041-2049, October, 1970. 4 ref.

Descriptors: *Flood control, *Flood plains, *Flood plain zoning, *Floods, *Hydraulics, Land use, Regulations, Rivers.

Although billions of dollars have been spent for the control of floods, it has been amply demonstrated that, on a nationwide basis, the effort to reduce flood damages is being lost. The flood control program's inability to maintain its early advantage is primarily attributable to rapidly increasing development on flood plains lands. The Tennessee Valley Authority pioneered the comprehensive flood damage prevention concept, portions of which have served as models for later endeavors by various states. Activities by 10 selected states in flood plain identification and management are cited as examples of the concept's past and continuing evolution. Most active state efforts are oriented toward providing adequate identification of flood plains and assisting local entities in implementing appropriate management of designated flood hazard areas. Technical, administrative, and legal problems are noted, as well as similarities to other social and economic needs of society. (Preckwinkle-Chicago)
W71-02147

PLANNING FOR PLEASURE BOATING ON REGIONAL BASIS,
Corps of Engineers, Seattle, Wash.
Ellsworth J. Gullidge, and Frank J. Uraback.
Journal of the Waterways, Harbors and Coastal Engineering Division, ASCE, Vol 96, No WW3, Proc paper 7453, August, 1970, p 583-600. 7 fig, 5 tab, 4 ref.

Descriptors: *Recreation facilities, *Boats, *Marinas, *Channels, *Planning, Navigation.
Identifiers: Moorings, Puget sound, Shipbuilding.

A regional study of Pudget Sound and adjacent waters, in Washington State, provided comprehensive information for use in planning of small boat harbors and other facilities required by pleasure boaters. This study included: an inventory of existing facilities and shoreline; measurement of marine facility demand by a questionnaire survey; comparison of demand with existing facilities to determine needs for additional facilities and projections of needs to 1980, 2000 and 2020. The paper displays a systematic approach towards the measurement of boater demand, both of quality and quantity, thus providing techniques for use by planners seeking to plan and develop facilities for pleasure boating. (Preckwinkle-Chicago)
W71-02148

STORM WATER FOR FUN AND PROFIT,
Chicago Univ., Ill. Center for Urban Studies.
John R. Sheaffer.
Water Spectrum, Vol 2, No 3, p 29-34, Fall 1970. 7 fig, 1 tab.

Descriptors: *Storm runoff, *Planning, *Environmental engineering, *Multiple-purpose projects, *Benefits, *Water supply, *Recreation, *Flood protection, Detention reservoirs, Retention, Storm water, Groundwater.
Identifiers: *Metropolitan resource management, *Closed systems planning, *Potential resources, *Open space.

A conceptual framework for storm-water management is presented illustrating in several case studies opportunites to capitalize upon a wide range of benefits. The three basic principles in the framework are: (1) the environment is a single unit with air, land, water and urban development interacting; (2) the earth for planning purposes is a closed system; (3) storm water is a potential resource out of place. The unity of the environment places storm water in a comprehensive perspective. Interchanges between surface and groundwaters and effects of urban land uses on distribution and quality must be recognized so that external costs will not affect drainage benefits. Considered within a closed system, the problem becomes one of space allocation. And viewed as a resource, location becomes an important factor. It is simply improper location that makes storm water a problem. When viewing storm water as a resource, quality must be carefully considered, particularly the initial flush which has been shown to be highly polluted. Therefore, a distinction must be made between detention and retention reservoir. When storm water is to be retained, it must be in an unpolluted condition or given treatment before storage. The six case studies discussed are: Storm water management at the Flick-Reedy plant in Bensensville, Illinois; Leetsdale-Oneida Apartment development at Denver; Howard Gulch flood control project in Denver; Skyline urban renewal project in Denver; Marcy Forest View Apartment development in Arlington Heights, Illinois; and the Indian Lakes storm drainage design in Bloomingdale, Illinois. All six cases illustrate in varying degrees the synergistic benefits of water supply, flood damage reduction, recreation, and open space. (Preckwinkle-Chicago)
W71-02150

COMMUNITY DECISION STRUCTURE AND URBAN PLANNING PROCESS,
Bureau of Public Roads, Washington, D.C.
Thomas J. Hillegass, Charles C. Schimpeler, and William F. Grecco.
Journal of the Urban and Development Division, Proceedings of the American Society of Civil Engineers, Vol 96, No UP1, p 17-22, March 1970. 1 tab, 9 ref.

Descriptors: *Planning, *Methodology, *City planning, *Decision making, Community development, Urban sociology, Political aspects, Social aspects, Attitudes, Social values.
Identifiers: *Community influentials, Community goals, Community objectives.

Professionals must be able to identify the power structure in a given community. If influential people are involved in the initial formulation of goals and objectives reflecting the broadly based value systems of the community, these same people will make the decisions, public and private, essential to implementing the adopted comprehensive urban plan. Community influence patterns are diverse and vary, in point in time, area of community interest as to whether influence is overt and direct, or indirect. Political scientists propose several means of identifying influential persons. These are position potential, issue examination, reputional technique, and social participation. A criterion for the selection of a committee to formulate community goals and objectives in a manner consistent with a broadly based community value system considers that the committee should consist of direct and indirect influentials, including public officials and representatives of commerce and industry, who are directly influential in controlling development decisions; and those indirect influentials who by reason of their personal stature and demonstrated interest are effective in shaping policies on important community issues. (Davis-Chicago)
W71-02152

URBAN PLANNING AND DEVELOPMENT OF RIVER CITIES,
Vollmer Associates, New York.
Arnold H. Vollmer.
Journal of the Urban Planning and Development Division, Proceedings of the American Society of Civil Engineers, Vol 96, No UP1, p 59-64, March 1970.

Descriptors: *Planning, *Cities, *Rivers, *City planning, Navigable waters, Conservation, Land use, Water pollution, Recreation.
Identifiers: *River cities, Metropolitan areas, Waterfronts.

The past provides a wealth of information testifying to the undeniable importance of locating cities on navigable bodies of water for purposes of trade, transportation, and protection. However, our present life style does not demand this same situation in order to grow and economically prosper. As man has evolved, so has his relationship to his environment, in this case his relationship to the waterfront. While the absolute necessity of waterfront location has become absolete, the sites themselves have become unsightly and neglected. Waterfronts, once the pride of the cities, have in many instances become the scars of the cities. As the demands for rivers as transportation and trade routes diminished, new demands evolved. The river became the transporter of sewage, the refuge of the pleasure seeker. The new demands often conflict with one another, yet they are of equal importance. While man's relationship to the waterfront is constantly evolving, function and esthetics are still key words in planning considerations. The aim must be progress in river city planning which will meet these demands and allow for order and meaning within the changing relationship between the river and the city. (David-Chicago)
W71-02153

THE STATE OF THE ART OF PLANNING,
Bartholomew (Harland) and Associates, Memphis, Tenn.
William S. Pollard, and Daniel W. Moore.
Journal of the Urban Planning and Development Division, Proceedings of the American Society of Civil Engineers, Vol 95, No UP1, p 27-42, April 1969. 7 fig, 10 ref.

Descriptors: *Planning, *Methodology, Systems analysis, Decision-making, Environment, Social aspects, City planning.
Identifiers: *Policy, *Inter-disciplinary teams, *Research, Operations research, Applied research.

The paper is based on a planning philosophy which attempts to deal with the total environment: social, economic, and physical. It describes the complex interrelationships among the many professions, so-

cial groups, and organizations involved in planning and suggests that an approach involving systems analysis and multi-disciplinary teams is required. Current planning practice is analyzed by means of a matrix which relates 43 kinds of planning studies with 28 technical steps required for their successful completion. The need for better techniques is emphasized for evaluating planning performance and to present a method for devising such techniques. Planning decisions are postulated and solutions to planning problems are sought mainly through one of the following approaches: (1) Policy; (2) judgement; (3) analysis and judgement; (4) operations research; and (5) applied research. (David-Chicago)
W71-02154

ACCESSIBILITY AND ENVIRONMENTAL QUALITY,
British Columbia Univ., Vancouver. School of Community and Regional Planning.
V. Setty Pendakur, and G. R. Brown.
Journal of the Urban Planning and Development Division, Proceedings of the American Society of Civil Engineers, Vol 95, No UP1, p 43-59, April 1969. 4 fig, 3 tab, 15 ref.

Descriptors: *Planning, *Environment, *Attitudes, Systems analysis, Social values.
Identifiers: *Environmental quality, *Accessibility.

A technique is outlined which could be of use in metropolitan water resources management, especially in the investigation of conflicting uses of the water resource. A systems framework is developed which portrays the components of the conflict between environmental quality and accessibility. Elements which serve to measure pedestrian safety, comfort, convenience and visual sensation are compared with those measuring motor vehicle driver safety, convenience, penetration and visual harmony. A pilot study was made, and pedestrian interviews conducted in an attempt to analyze perceptual responses to the environment. Two conclusions emerged from the study: (1) That it is possible to measure the environmental quality-accessibility conflict by attitude survey; and (2) that people are more consciously aware of problems of accessibility than of those of environmental quality. (Davis-Chicago)
W71-02155

LAKE MICHIGAN DEVELOPMENT PROPOSAL.
Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05G.
W71-02156

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

PRICE, DEMAND, COST, AND REVENUE IN URBAN WATER UTILITIES.
Hittman Associates, Inc., Columbia, Md.
For primary bibliographic entry see Field 06D.
W71-01837

AN ECONOMIC STUDY OF THE EFFECT OF MUNICIPAL SEWER SURCHARGES ON INDUSTRIAL WASTES,
North Carolina Water Resources Research Inst., Raleigh.
For primary bibliographic entry see Field 05G.
W71-01897

ECONOMICS OF LIQUID-MANURE DISPOSAL FROM CONFINED LIVESTOCK,
Purdue Univ., Lafayette, Ind. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 05D.
W71-02029

SWINE MANURE -- LIABILITY OR ASSET,
Purdue Univ., Lafayette, Ind.
For primary bibliographic entry see Field 05D.
W71-02047

GUIDELINES FOR ESTABLISHING ECONOMIC AND ENGINEERING FLOOD CRITERIA,
Washington Univ., Seattle; and Washington State Univ., Pullman.
P. W. Barkley, D. L. Bender, H. D. Copp, J. G. Hattersley, and J. F. Osborn.
Commentary on Improving the Flood-Associated Activities of the State of Washington Dep of Water Resources Olympia, Report No 4, Part A, State of Wash. Water Research Center, Pullman, June 1970. 103 p, 18 fig, 8 tab, 2 append.

Descriptors: *Flood control, *Cost-benefit analysis, *Economics, *Flood damage, Hydrologic aspect, State jurisdiction, Washington.

The study described was designed to establish criteria for determining what portion of the costs for a flood control project for the State of Washington should be supported with State funds. Guidelines for establishing criteria to meet the needs of specific projects were described for flexibility and efficiency. An evaluation of past flood control activities by the State was provided. Recommendations were made to improve the efficiency of future flood damage alleviation activities. These recommendations included: (1) development of a state-wide, master policy and plan for flood damage alleviation; (2) initiation of a dynamic public information program on flood plain management; (3) approval of only local benefit projects; (4) requirement of more detailed information for entities requesting funds for flood projects; (5) enactment of zoning and land-use regulations governing the flood plain for counties and cities with flood problems; and (6) procedures for objective review of all projects. The recommendations were made on the basis of eighteen months of study. A brief history of the flood control division, flood damage reduction programs in other states, alternatives to the structural approach to flood damage reduction, the availability of hydrologic information and flood plain information studies and economic guidlines for evaluating project proposals and determining the level of state support were the topics discussed. (Kriss-Cornell)
W71-02079

THE ALLOCATION AND PRICING OF WATER IN A RIVER BASIN,
Guelph Univ. (Ontario); and University of New England, Armidale (Australia).
J. C. Flinn, and J. W. B. Guise.
American Journal of Agricultural Economics, Vol 52, No 3, Aug 1970, p 411-421. 35 ref, 3 tab.

Descriptors: *Water allocation (Policy), Operating costs, Water rates, Equilibrium prices, Mathematical model, Cost analysis, Analytical techniques.
Identifiers: *Yanco Irrigation Area, Murrumbidgee Irrigation Area, New South Wales, Australia.

A spatio-temporal equilibrium model that incorporates intraseasonal demands for irrigation water is developed for the situation with a (constrained) competitive market for water. An application of the quadratic programming model, which utilizes demand and supply estimates relating to an intensive irrigation area in Southeastern Australia, is used to derive optimal short-run allocation and pricing patterns for the resource. Extensions of the model to cover multiple dam river basins and additional water uses seem conceptually straightforward, but the limitations imposed by its deterministic partial equilibrium character should be recognized. (Holmes-Rutgers)
W71-02107

ALLOCATING A LIMITED SUPPLY OF WATER FOR IRRIGATION,
Nebraska Univ., Lincoln.
For primary bibliographic entry see Field 03F.
W71-02108

IRRIGATION WATER SUPPLY: EFFICIENCY AND COST ASPECTS,
Nebraska Univ., Lincoln. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 03F.
W71-02109

CHAPTER VIII, MULTIPLE-OBJECTIVE PLANNING, BENEFIT-COST ANALYSIS AND DISCOUNT RATE.
For primary bibliographic entry see Field 06B.
W71-02138

6D. Water Demand

PRICE, DEMAND, COST, AND REVENUE IN URBAN WATER UTILITIES.
Hittman Associates, Inc., Columbia, Md.

Available from the NTIS as PB-195 929, $3.00 in paper copy, $0.95 in microfiche. Hittman Associates, Inc Report HIT-474, September 1970. 106 p, 18 tab, 3 fig, 51 ref, 2 append. OWRR Project C-1790 (3168) (1).

Descriptors: *Water demand, *Water costs, *Water rates, *Elasticity of demand, *Economic evaluation, *Statistical models, Municipal water, Cost allocation, Public utilities, Regression analysis, Operating cost, Michigan.
Identifiers: *Rate-making policy, Detroit (Mich), Roseville (Mich).

The effects of rate-making policy on urban water utilities were investigated, including relationships between price, demand, cost, and revenue. The findings of other investigators were reviewed and analyzed, particularly estimates of the price elasticity of municipal water demands. Data were collected directly from 46 urban water utilities. Statistical methods were used to develop functional expressions for mean, maximum day, and peak hour demand; operating cost; and various classes of revenue. These functional expressions were incorporated into a general economic model of urban water utilities. Two case studies were performed using the economic model, based on data from Detroit and Roseville, Michigan. The case studies were used to illustrate the effect of a postulated rate increase on demand, cost, and revenue. Other applications of the economic model are described, including investigations of the distribution of demand, cost, and revenue among various classes of water users under alternate pricing strategies. Functional expressions for water demands were found to agree closely with those developed by other investigators. Operating cost functions and revenue functions incorporate correlations not previously reported. (Boland-Hittman)
W71-01837

LONG ISLAND WATER RESOURCES.
New York State Office of Planning Coordination, Albany.

Available from NTIS as PB-194 199, $3.00 in paper copy, $0.95 in microfiche. State Conservation Department Report, Jan 1970. 64 p, 16 tab, 15 fig, 35 ref. HUD Project No NYP 1/6.
Identifiers: *Water resources, New York, Regional planning, Groundwater, Water consumption, Water conservation, *Long Island water resources, Long Island.

The report discusses the unique problems of Long Island, stemming from its reliance upon a groundwater reservoir. Supplemented by tables, maps and graphs, the text explains available supplies, man-made problems which influence supplies, present and future water demands for diverse purposes and alternative methods of meeting future demands. Also included are sections from the State Conservation Law, describing the procedure for forming a regional water resources planning board.

W71-01988

AN APPLICATION OF SPATIAL EQUILIBRIUM ANALYSIS TO WATER RESOURCE ALLOCATION,
Guelph Univ. (Ontario); and University of New England, Armidale (Australia).
For primary bibliographic entry see Field 06A.
W71-02091

STOCHASTIC IRRIGATION PLANNING MODELS,
Harvard Univ., Cambridge, Mass. Center for Population Studies.
For primary bibliographic entry see Field 06A.
W71-02096

6E. Water Law and Institutions

YOUNG V SCOTT (LIABILITY FOR OBSTRUCTION OF FLOW OF SURFACE WATER FROM DOMINANT ESTATE).

250 NW 484-486 (Iowa 1933).

Descriptors: *Iowa, *Dikes, *Diversion structures, *Surface runoff, Watersheds (Divides), Legal aspects, Judicial decisions, Remedies, Damages, Drainage, Drainage water, Riddance (Legal aspects), Concrete structures, Relative rights, Over-lying proprietor, Surface drainage, Obstruction to flow, Surface waters.

Plaintiff dominant estate owner sought an injunction to compel defendant servient estate owner to remove a dike which ran along the boundary line between their two tracts of land. Plaintiff contended that a dominant estate owner had a right to the unobstructed natural flow of drainage water from his land. Defendant contended that the dike had been in existence for forty years pursuant to an oral agreement between the parties. The Supreme Court of Iowa held that while it is well settled law that a dominant estate owner has a right to the unobstructed natural flow of drainage water from his land onto a servient estate, that right was overcome in the instant case upon sufficient proof of an oral agreement to erect a dike to drain the surface water in another manner. The trial court's judgment for defendant was affirmed. (Quesada-Florida)
W71-01655

A STUDY OF VARIOUS PROCEDURES UTILIZED BY SELECTED WATER-ORIENTED SPECIAL DISTRICTS WHICH ARE COMMON TO ALL OF THEM,
Washington Univ., Seattle. School of Law.
Beverly J. Rosenow.
Available from NTIS as PB-195 828, $3.00 in paper copy, $0.95 in microfiche. Completion Report. Resources Research Project No. A-030, Washington State University. 157 p, 8 charts, 3 append. OWRR Project A-030-WASH (1).

Descriptors: *Water-oriented special districts, *Commercial waterway districts, *Diking districts, *Flood control districts, *Flood control zone districts, Intercounty diking, Rehabilitation districts, *Public waterway districts, Governing bodies, Elections, Voter qualifications, Consolidation procedures, Reorganization procedures, Merger procedures, Dis-solution procedures. Uniform procedures act.
Identifiers: *Drainage districts, Drainage, *Water districts, Diking, *Sewage districts, Flood control, *Investigation districts, Public utility districts, Legislation, Water rights, Public rights.

This study analyzes selected common procedures prescribed by statute for several water-oriented special districts authorized in the State of Washington. Extensive differences were found in the procedures studies (formation, governing bodies, elections, consolidation, merger, reorganization, and dissolution). These differences are discussed in the text and reflected in accompanying comparative charts which summarize the governing statutes. It is concluded that development of uniform procedures in these areas is feasible. However, recommended as a better approach is creation of a single type of overall water management district authorized to carry out all of the water resource functions now spread among the man types of special districts with some jurisdiction in this area. Formation of a special commission to consider the feasibility of developing such broad legislation is suggested. In the course of gathering and anlyzing the special districts materials noted in this study, it was found that many efforts are being made to improve the structure of special district governments and that much more needs to be done to make the administration and operations of such districts more responsive and efficient. Suggestions are made for establishing a central record-keeping operation for all special districts presently existing in the state and for formation of a special districts association. Repeal of the never-utilized public waterway district legislation is recommended. (Rosenow-Washington)
W71-01657

MILLER V ZAHN (DOMINANT ESTATE'S LIABILITY FOR COLLECTION AND DISCHARGE OF SURFACE RUNOFF).

264 Mich 306, 249 NW 862 (1933).

Descriptors: *Michigan, *Drainage water, *Surface runoff, *Riddance (Legal aspects), Damages, Drainage systems, Concrete structures, Water management (Applied), Remedies, Legal aspects, Judicial decisions, Drains, Tiles, Tile drains, Impoundments, Impounded water, Land management.

Plaintiff servient estate owner sought to enjoin defendant dominant estate owner from collecting surface runoff and pouring it through an artificial ditch and tile drain onto plaintiff's servient estate. Plaintiff also sought to collect damages for water injury to his land. While conceding that a dominant estate owner had a right to have natural surface runoff flow onto the servient estate, plaintiff contended that this right could not be abused by increasing the burden on the servient estate through artificial collection and riddance. Defendant contended that the damage was due to an unusually heavy rainfall and denied that it was the product of the articial system employed by him. The Supreme Court of Michigan held that a dominant estate owner cannot, by collecting and concentrating the surface waters, abuse his lawful right to natural surface runoff. (Quesada-Fla)
W71-01661

BYRAM V LAWEIN (DISCHARGE OF SEWAGE WATER ONTO ANOTHER'S LAND).
232 NW 907-909 (SD 1930).

Descriptors: *South Dakota, *Sewage, *Riddance (Legal aspects), *Discharge (Water), Surface water, Septic tanks, Surface runoff, Surface drainage, Watercourses (Legal), Right-of-way, Railroads, Sewers, Land tenure, Culverts, Water pollution, Sewage disposal, Odor, Legal aspects, Judicial decisions, Wastes, Waste disposal, Overflow.

Plaintiffs sought to enjoin defendant from maintaining a septic tank near defendant's businesses and from discharging the overflow water from the tank onto plaintiffs' right-of-way. Plaintiffs proceeded upon two theories: (1) that the overflow from defendant's septic tank constituted a public nuisance; and (2) that defendant had no right to discharge water of any character upon plaintiff's land. The trial court denied the injunction. The South Dakota supreme court reversed. Plaintiffs were correct in their contention that defendant had no right to drain any water, other than the natural surface water, onto plaintiffs' right-of-way. The fact that defendant's discharge was minimal in quality and that the damage was also minimal did not authorized refusal of the injunction where the trespass was a continuing one. (Duss-Fla)
W71-01667

GREENFIELD V POWELL (TITLE TO ACCRETED PROPERTY).
118 So 556-559 (Ala 1928).

Descriptors: *Alabama, *Boundary disputes, *Boundaries (Property), *Accretion (Legal aspects), Streamflow, Real property, Land, Legal aspects, Judicial decisions, Stream erosion, Streams, Bank erosion, Running waters, Land tenure, Channels, Non-navigable waters, Relative rights.

Plaintiff and defendant owned property separated by a non-navigable stream. The course of the stream changed over a period of time, decreasing the area of plaintiff's property as bounded by the stream. Defendant claimed title to the property, which was previously plaintiff's, as accretion to his land. Plaintiff claimed the description in defendant's deed limited his property to a certain section of land, and that insofar as the allegedly accreted property extended over the section line, it was not defendant's. The Supreme Court of Alabama reversed a judgment for Plaintiff, finding that the stream in question changed course in a gradual manner consistent with accretion. Where a non-navigable stream is the boundary between adjacent landowners, each owner takes to the thread of the stream. Grants limited to a specific section of land may not by accretion be extended into another section, but the court found in the instant case that the description in defendant's deed did not limit his property to any specific section. (Dye-Fla)
W71-01668

STATE V TIMOTHY (DOCTRINE OF PURPRESTURE LIMITS PRIVATE CONSTRUCTION ON LAKE BED).
166 La 738, 117 So 812-814 (1928).

Descriptors: *Louisiana, *Ownership of beds, *Public rights, *Lake beds, Legal aspects, Judicial decisions, Remedies, State governments, Legislation, Lakes, Recreation facilities, Navigable waters, Engineering structures, Structures, Water rights, Social aspects, State jurisdiction, Regulation, Remedies.
Identifiers: *Purpresture.

Plaintiff state sued to require defendant to demolish a two-story bathhouse he had constructed 300 feet from shore on the bed of a state-owned lake. Defendant operated the bathhouse as a private business. Plaintiff argued that the common law doctrine of purpresture applied. Defendant contended the doctrine was limited to public things whose title is vested in the state, but not 'common things' which belong to no one, and which all men may use. The Supreme Court of Louisiana, in affirming a lower court decision for plaintiff, held that defendant could not invoke the statutory 'common things' protection because even if the lake bed were a common thing the permanent bathhouse was not a natural use contemplated by the statute. Since title to the lake bed rests in the state, it may sue to abate a purpresture or eject a trespasser on the public domain. (Morris-Florida)
W71-01673

GEISERT V CHICAGO R I AND P RY (SERVIENT LANDS MUST SUFFER CONSEQUENCES OF UNRESTRAINED FLOW OF DRAINAGE FROM DOMINANT ESTATES).

42 SW2d 954-957 (Mo 1931).

Descriptors: *Missouri, *Drainage practices, *Bridges, *Natural flow doctrine, Diversion structures, Damages, Ditches, Levees, Embankments, Drainage, Drain water, Culverts Natural streams,

Natural flow, Overflow, Missouri River, Land reclamation, Drainage districts, Sediment distribution, Accretion (Legal aspects), Alluvium, Excavation, Railroads, Judicial decisions, Legal aspects.

Plaintiffs landowner and corporation sought damages for injuries sustained allegedly as a result of defendant railroad's construction of a bridge over a creek and defendant landowner's digging of a ditch alleged to have altered the flow of the creek and increased the flow thereof onto plaintiffs' property. The court held that although one who diverts a watercourse from its natural channel must answer for damages, the alteration of the flow of the creek in the instant case was from natural causes. The court held further that defendant railroad had acted properly by constructing the bridge and allowing the water in its natural course to flow therethrough and that plaintiffs, as servient owners, had to suffer the consequences of the unrestrained flow of drainage onto their lands from dominant lands. The trial court's judgment for defendants was affirmed. (Price-Florida)
W71-01674

BOEHM V WERMUTH (DIVERSION OF STREAM FROM LANDOWNER'S PROPERTY).
215 NW 818-819 (Wis 1927).

Descriptors: *Wisconsin, *Streams, *Diversion structures, *Adjudication procedure, Alteration of flow, Natural flow doctrine, Obstruction to flow, Reasonable use, Relative rights, Water spreading, Judicial decisions, Legal aspects, Diversion.

Plaintiff riparian landowner sought a mandatory injunction against defendant upper riparian landowner. A stream divided into two courses on defendant's property, one course passing through plaintiff's tract. Plaintiff had obstructed the stream at this 'Y' division prior to defendant's purchase of his property, thereby diverting all the water through his land. After defendant's purchase, a flood washed this obstruction away, rediverting the stream back into the other course away from plaintiff's property. Defendant refused to permit plaintiff to enter upon his property to rebuild the obstruction, and plaintiff brought this action. Plaintiff contended that the trial court's fact findings were erroneous. Reviewing the evidence, the court affirmed the findings of the lower court, agreeing that defendant had no obligation to permit plaintiff to enter his property. (Hart-Florida)
W71-01677

EHLER V STIER (NULLIFICATION OF EASEMENT FOR DRAINAGE OF SURFACE WATER).
216 NW 637-639 (Iowa 1927).

Descriptors: *Iowa, *Surface drainage, *Easements, *Surface waters, Natural flow doctrine, Cities, Drainage systems, Flooding, Flood damage, Riddance (Legal aspects), Surface runoff, Drainage practices, Ditches, Water conveyance, Culverts, Roads, Judicial decisions, Legal aspects, Prescriptive rights, Relative rights.

Plaintiff landowner sought to enjoin defendant township from maintaining a culvert which drained surface water onto his property. Plaintiff's land and an adjoining owner's upper tract were separated by a road. Surface water drained from the upper tract through the culvert in the road and flooded plaintiff's land. Plaintiff's predecessor in title had obtained a permanent injunction prohibiting installation of the culvert, but a later predecessor had agreed orally with the adjoining landowner to ditch the road and to allow defendant to install the culvert. Plaintiff contended that the injunction prohibitied the ditches and culverts, while defendant alleged that a permanent drainage easement was created by plaintiff's predecessor, and that plaintiff received his property thus burdened. The court noted that if the drainage easement was permanent, it could not be nullified except by mutual consent. The previous owner's agreement was held to create a permanent easement which burdened plaintiff's estate at his purchase. The court summarily rejected plaintiff's assertion that the culvert size was restricted by the injunction, and affirmed the lower court's decision for defendant. (Hart-Florida)
W71-01682

SANDERS V DE ROSE (INJUNCTION TO PREVENT TRESPASSING UPON A PRIVATE LAKE).
191 NE 331-334 (Ind 1934).

Descriptors: *Indiana, *Lakes, *Ownership of beds, *Fishing, Sport fishing, Farm ponds, Recreation, Boundaries (Property), Water utilization, Competing uses, Nonconsumptive use, Legal aspects, Judicial decisions, Land tenure.

Plaintiff lake owner sought to enjoin defendant citizen from fishing and trespassing upon his lake. The lake, non-navigable and unconnected with navigable waters, lay almost wholly within plaintiff's boundary, except for a small portion lying within the adjoining private tract. Plaintiff operated a fishing camp on the lake. Defendant entered the lake with permission of the adjoining landowner, and refused to depart at plaintiff's request, asserting to plaintiff's customers that plaintiff did not own the waters of the lake above plaintiff's lake bed and could not charge them to fish in the lake. Plaintiff claimed control of the lake bed. The court noted that since plaintiff's lake-bed boundary was fixed by congressional survey, it was as certain as plaintiff's upland boundary. The common law was held to apply. Plaintiff had the right to unmolested use and control of his portion of the lake bed and the water thereover. Plaintiff's requested injunction was granted. (Hart-Florida)
W71-01685

VILLAGE OF ORRVILLE V GOCHNAUER (MEASURE OF DAMAGES FOR STREAM POLLUTION).
183 NE 391-393 (Ohio 1932).

Descriptors: *Ohio, *Water pollution, *Damages, *Compensation, Cities, Water pollution sources, Water pollution effects, Judicial decisions, Legal aspects, Adjudication procedure, Streams, Farms, Crops, Agriculture, Odor, Potable water, Cattle, Domestic animals, Poultry, Rent.
Identifiers: Orriville (Ohio).

Plaintiff farm owner sued defendant village for damages caused by pollution injury. Verdict and judgment were rendered for plaintiff. On appeal, defendant charged that the trial court had erred in failing to grant a judgment n.o.v. Defendant had queried the jury for special findings and had elicited a reply that rental value was not considered in reaching the verdict. To another question, the jury replied that the amount of damages awarded for foul odors from the polluted creek were $250. Defendant contended that these findings were inconsistent since the damages from odor could properly be established only by considering rental value. Furthermore, since the court had charged the jury that the measure of damages was the diminution in rental value, defendant asserted that the jury had failed to follow the court's instructions. After stating that a clear and irreconcilable conflict was required to overturn the verdict, the court held that such a conflict did not exist in the instant case. The court went on to hold that the questions of special findings were improper, and affirmed the lower court's decision for plaintiff. (Hart-Florida)
W71-01691

LYON V WATER COMM'RS OF CITY OF BINGHAMTON (RIGHT OF RIPARIAN OWNER TO FULL FLOW OF STREAM).

228 App Div 585, 240 NYS 647-654 (1930).

Descriptors: *New York, *Diversion, *Riparian rights, *Water demand, Prescriptive rights, Cities, Riparian land, Riparian waters, Diversion losses, Dams, Wells, Legislation, Judicial decisions, Legal aspects, Mills, Mill dams, Reservoirs, Water storage, Water supply, Damages, Remedies, Municipal water, Relative rights.

Plaintiff riparian owner and dam operators sought to enjoin defendant city from diverting water from the river above plaintiffs' dam. Plaintiffs' predecessor in title had legislatively secured the right to operate the mill dam on the river. Defendant had diverted the water because it was the only source of water for the city, and claimed a prescriptive right to such water diversion. The court ruled that plaintiffs, as riparian owners, had the right to enjoy the full flow of the stream. By wrongfully diverting the water, the city had gained no prescriptive rights thereto. However, since plaintiffs suffered no substantial damages, and since the river was the only source of supply for city water, the lower court's injunction against defendant was suspended until such time as plaintiffs suffered substantial damage. An award of nominal damages preserved plaintiffs' title and prevented defendant's securing prescriptive rights. (Price-Florida)
W71-01692

HAMMOND V ANTWERP LIGHT AND POWER CO (LIMITATIONS ON PRESCRIPTIVE RIGHT TO DIVERT STREAM FLOW).
132 Misc Rep 786, 230 NYS 621-639 (1928).

Descriptors: *New York, *Water utilization, *Prescriptive rights, *Water levels, Diversion dams, Relative rights, Riparian rights, Reservoirs, Lakes, Navigable waters, Diversion structures, Reasonable use, Prior appropriation, Damages, Remedies, Legal aspects, Judicial decisions, Consumptive use, Artificial use, Legislation.

Plaintiff lower riparian landowners sought to enjoin defendant power company from drawing water from its dam at the head of the stream upon which plaintiffs' lands abutted. Defendant maintained a dam at the mouth of the lake from which the stream flowed. Plaintiffs contended that while defendant might have acquired a prescriptive right to dam the water flowing from the lake outlet, it was restricted in the amount, manner, and purpose of such withdrawal. Plaintiffs further contended that defendant had not established a prescriptive right to diminish the flow onto the stream flowing through plaintiffs' lands. Defendant contended that it had acquired a prescriptive right both to dam the flow and to use the water for whatever purposes it chose. Additionally, defendant denied that it had impaired the flow onto plaintiffs' lands. The court held that when an upper riparian owner acquires the right to raise the water level to a certain height, other riparian owners acquire a reciprocal easement to have the water maintained at that height and used for the same purposes. (Quesada-Florida)
W71-01693

KNAUTH V ERIE RR (ACQUISITION OF PRESCRIPTIVE RIGHT TO DIVERT WATER).
219 App Div 83, 219 NYS 206-212 (1926).

Descriptors: *New York, *Streamflow, *Diversion, *Prescriptive rights, Relative rights, Riparian rights, Artificial use, Consumptive use, Water utilization, Diversion dams, Damages, Remedies, Legal aspects, Judicial decisions, Structures, Prior appropriation, Water levels, Adjudication procedure, Water demand.

Plaintiff lower riparian landowner sought to enjoin defendant upper riparian railroad from diverting water to the extent of depriving him of sufficient water to operate his mill. Plaintiff contended that he had forcibly removed defendant's dam before the passing of the required statutory period for defendant to establish a prescriptive right. Furthermore, plaintiff maintained that defendant had the burden of proving a prescriptive right to draw the

amount of water it was drawing at the time of the action. Defendant contended that it had so established a prescriptive right by reason of having diverted water without interruption for the statutory period. The court held that while a prescriptive right to divert the water of a stream may be acquired by uninterrupted diversion for the statutory period, defendant had the burden of proving such right by indubitable proof. Moreover, the court held that in order to establish a prescriptive right, there must have been appreciable diminution in the natural flow of the stream to the injury of the lower riparian owner from the beginning of the statutory period. The court held that defendant had not established a prescriptive right and affirmed the trial court's judgment for plaintiff. (Quesada-Florida)
W71-01696

STEVENS HOTEL CO V CHICAGO YACHT CLUB (ERECTION OF BUILDING AS BURDEN ON SCENIC EASEMENT).
399 Ill App 463, 171 NE 550-554 (1930).

Descriptors: *Illinois, *Scenic easements, *Riparian rights, *Lake Michigan, Lakes, Cities, Roads, Riparian waters, Buildings, Landfills, Easements, Judicial decisions, Legal aspects, Parks, Aesthetics, Land use, Scenery, Relative rights.
Identifiers: Chicago (Ill).

Plaintiff hotel owner sought to enjoin defendant yacht club from erecting a building on the shore of Lake Michigan. Plaintiff's hotel was situated on an avenue along Lake Michigan; a park extended to the lakeshore on the opposite side of the avenue. Plaintiff had an easement appurtenant in the park which prevented erection of buildings there. The city dredged in the lake bed adjacent to the park to a harbor line established by the Secretary of War. Defendant proposed to erect a clubhouse on land dredged in outside of this harbor line. Plaintiff contended that erection of the clubhouse would burden his easement. The court determined that plaintiff's easement extended throughout the dredged in portion of the park, as well as in the original park. However, the court found that plaintiff had no riparian rights other than those of the general public. Since the proposed site was beyond the harbor line to which plaintiff's easement extended, the court held that the easement would not be burdened by the new clubhouse, and affirmed the lower court's decision for defendant. (Hart-Florida)
W71-01724

NORTH-EAST COAL CO V HAYES (LIABILITY FOR DAMAGES TO FARM BY COAL MINE).

244 Ky 639, 51 SW2d 960-963 (1932).

Descriptors: *Kentucky, *Coal mines, *Damages, *Water pollution, Coal mine wastes, Water pollution sources, Hydraulic mining, Pollutants, Water pollution effects, Compensation, Reasonable use, Wells, Streams, Flooding, Soaking, Flood damage, Drainage systems, Judicial decisions, Legal aspects, Adjudication procedure, Farms, Property values.

Plaintiff landowner sued defendant coal mining company for damages caused by defendant's mining operation. Defendant, who owned the mineral rights to plaintiff's land, had allegedly caused three injuries to plaintiff: (1) an inadequate drain pipe caused water to run onto plaintiff's bottom land; (2) waste mining water polluted a creek which ran through plaintiff's property; and (3) plaintiff's well was contaminated. The court held defendant liable for injury from the inadequate drain. However, defendant was held not liable for the well pollution since the source of the pollution was underground, and therefore it could not have been avoided with reasonable care. As to the stream pollution, the court stated that if it could have been prevented by reasonable care, defendant was liable and remanded the issue for a new trial. The court determined that the measure of damages for temporary injury was the diminution in rental value, whereas the measure for permanent injury was the dinimution in fair market value. (Hart-Fla)
W71-01733

LOUISVILLE AND N RR V SALTZER (RAILROAD'S LIABILITY FOR BANK EROSION CAUSED BY REROUTING OF RIVER).
144 SE 456-458 (Va 1928).

Descriptors: *Virginia, *Railroads, *Rivers, *Bank erosion, Banks, Streamflow, Alteration of flow, Routing, Damages, Riparian land, Riparian waters, Erosion, Channel erosion, Construction, Diversion, River training, Judicial decisions, Legal aspects, Adjudication procedure.

Plaintiff landowner brought action against defendant railroad to recover for erosion damage to his land caused when defendant, during construction, changed the course of a river running through plaintiff's property. Defendant raised the statute of limitations, contending that the cause of action arose in 1891 when construction was completed whereas plaintiff brought his action in 1923. Plaintiff contended that no erosion occurred until 1918. The court noted that, while plaintiff had the burden of proving damages, defendant had the burden of proving the facts supporting its statute of limitations defense. Finding that the conflicting evidence was properly submitted to the jury, the court affirmed the judgment for plaintiff. (Liptak-Fla)
W71-01744

AMERADA PETROLEUM CORP V LOUISIANA MINERAL BD (OWNERSHIP OF ROYALTIES FROM MINERAL LEASE IN STREAMBED).
203 La 473, 14 So 2d 61-72 (1943).

Descriptors: *Riparian rights, *Louisiana, *Accretion (Legal aspects), *Boundaries (Property), Bank erosion, Minerology, Drilling, Exploration, Legal aspects, Judicial decisions, Legislation, Oil wells, Oil industry, Oil reservoirs, Streambeds, Ownership of beds, Running waters, Streams, Leases, Royalties.

Plaintiff petroleum corporation, owner of an oil rights lease in a streambed, sought to interplead defendant state mineral board and a riparian owner, both of whom claimed the royalties under plaintiff's lease. Defendant mineral board contended that the royalties under the lease were rightfully due to it because the state held title to the streambed. Defendant riparian owner claimed the royalties on the theory that the oil was taken from accretion to which it held title as owner of the riparian lands adjacent to such accretion. The Supreme Court of Louisiana held that the portion from which the oil was taken was formed by accretion, and since such accretion was owned by the riparian owner and not the state of Louisiana, the riparian owner was entitled to the royalties from plaintiff's oil rights lease. (Quesada-Fla)
W71-01745

HEARINGS AND REPORT ON AMENDMENT TO THE WATERSHED AND FLOOD PREVENTION ACT BEFORE THE SUBCOMMITTEE ON CONSERVATION AND CREDIT, COMMITTEE ON AGRICULTURE, US HOUSE OF REPRESENTATIVES, 88TH CONG, 2ND SESSION.
Hearings and Report--Subcomm on Conservation and Credit--Amendment to Watershed and Flood Prevention Act--Comm on Agriculture, US House of Representatives, March 9, 1964; Oct 19, 1965.

Descriptors: *Watershed Protect. and Flood Prev. Act, *Soil conservation, *Flood protection, *Multiple-purpose projects, Flood control, Floodwater, Conservation, Water storage, Administrative decisions, Recreation, Dams, Reservoirs, Reservoir storage, Wildlife conservation, Eminent domain, Right-of-way, Federal government, Legislation, Floodways.

The Subcommittee on Conservation and Credit of the Committee on Agriculture met on March 19, 1964, to consider H.R. 9938, proposing to increase the limitation on floodwater detention capacity from 5,000 to 12,500 acre-feet and H.R. 9695, likewise offered to amend the Watershed Protection and Flood Prevention Act. Appearing before the Subcommittee were several representatives of the Soil Conservation Service and state conservationists, who presented statements regarding the 5,000 acre-foot limitation of floodwater storage in an effort to evidence the need for the legislation under consideration. Also discussed were the cost factors to be involved in the implementation of the projects called for by the bills, and possible problems in land acquisition. A favorable report and recommendation as to H.R. 9149, a bill to amend the Watershed Protection and Flood Prevention Act was included. Section Two of the Act (68 Stat 666) was amended as recommended by the Committee on Agriculture. (Price-Florida)
W71-01751

GLORE V HAGGARD (IMPLIED EASEMENT TO MAINTAIN PIPELINE FOR EXERCISE OF WATER RIGHTS).
143 SE 780-781 (Ga 1928).

Descriptors: *Georgia, *Water rights, *Easements, *Pipelines, Right-of-way, Prescriptive rights, Water supply, Distribution systems, Damages, Legal aspects, Judicial decisions, Relative rights, Water contracts, Water utilization, Domestic water, Water distribution (Applied), Contracts.

Plaintiff landowner brought action against defendant landowner to recover damages caused when defendant dug up and removed water pipes on defendant's property, thereby cutting off plaintiff's sole water supply. Plaintiff contended that the pipes were laid on the property by the common grantor of both lots before the grantor divided his land for sale and that the conveyance from the common grantor included the right to continued use of the water system. The court noted that the former owner's use of the pipeline created an easement appurtenant to maintain the pipes in order to enjoy the water rights. The court held that such an easement could be conveyed by general words and need not be specifically mentioned in plaintiff's deed. The trial court's granting of defendant's demurrer was reversed. (Liptak-Florida)
W71-01753

ELLERSON FLORAL CO V CHESAPEAKE AND O RY (LIABILITY FOR FLOODING CAUSED BY EXTRAORDINARY RAINFALL).
141 SE 834-836 (Va 1928).

Descriptors: *Virginia, *Surface drainage, *Culverts, *Obstruction to flow, Surface runoff, Legal aspects, Judicial decisions, Drainage, Land, Adjudication procedure, Floods, Precipitation excess, Drainage water, Rain water, Small watersheds, Surface waters, Damages, Flooding, Ravines, Railroads, Rain, Excessive precipitation.

Defendant railroad maintained an elevated roadbed across a ravine which was the only outlet for the small watershed in which plaintiff's property was located. A 36-inch pipe passed through the roadbed. On three occasions the pipe proved inadequate for passage of surface waters following heavy rains. The consequent flooding resulted in damage to plaintiff's crops. Plaintiff sought damages for a permanent nuisance. Defendant contended that the rains causing the damage were so unusual as to constitute an act of God and that the first instance of damage had occurred more than 5 years prior to the action so that an action based thereon was barred by the statute of limitations. The court in reversing the trial court's judgment for defendant, held that the statute of limitations does not run until it may be definitely determined that the damage is permanent, which determination was made in this case on the date of the second instance of damage. No evidence showed that the pipe was adequate during foreseeable storms. The act of

God doctrine was thus not applicable. (Dye-Florida)
W71-01770

WASHINGTON WATER CO V PARRETT (DAMAGES FROM DAM OVERFLOW).
9 F2d 915-916 (6th Cir 1926).

Descriptors: *Dams, *Ohio, *Remedies, *Subsidence, Riparian land, Soaking, Submergence, Withdrawal, Overflow, Flood damage, Streams, Maximum probable flood, Damages, Adjudication procedure, Legal aspects, Judicial decisions, Flooding, Saturation, Water spreading, Floodwater, Impoundments, Water injury.

Plaintiff riparian landowner sought to enjoin defendant water company from maintaining a dam on a creek downstream from plaintiff's land. The trail court found that the dam caused a delay in subsidence of water from plaintiff's land, thereby injuring plaintiff's property slightly, and ordered defendant to either remove the dam or alter it to prevent water from backing up onto plaintiff's land. On appeal, the court held that the trial court's remedy was wholly disproportionate to plaintiff's injury and inequitable in consideration of defendant's large expenditure in the dam. Accordingly, the case was remanded for a determination of damages. (Hart-Florida)
W71-01811

BELLAIRE, BENWOOD AND WHEELING FERRY CO V INTERSTATE BRIDGE CO (BRIDGE CONSTRUCTION OVER NAVIGABLE STREAMS).
40 F2d 323-328 (4th Cir 1930).

Descriptors: *West Virginia, *Federal jurisdiction, *Navigable rivers, *Bridge construction, Federal government, Ohio River, Navigation, Bridges, Legislation, Construction, Channels, Streams, Public rights, Piers, Abutments, Easements, State jurisdiction, Navigable waters, Boundaries (Property), Judicial decisions, Legal aspects, Watercourses (Legal).
Identifiers: Ferries.

Plaintiff ferry operator sought to enjoin erection of a bridge over the Ohio River. The bridge was to be erected pursuant to a congressional act. Plaintiff sought to enjoin defendants from appropriating land claimed by plaintiff, from interfering with the franchise and rights of plaintiff's ferry, and from interfering with plaintiff's ability to navigate the river. Defendants had the action removed to federal court. They denied plaintiff's land was being appropriated, that he had any navigational rights in the river, or that he would be unlawfully interfered with by erection of the bridge. Defendants further alleged that the stream, as to navigation, was under control of the federal government and that the bridge was authorized by Congress. The federal district court dismissed the bill of complaint and the circuit court affirmed. The federal courts had jurisdiction because the erection of bridges over navigable waters involves the laws of the United States. The trial court was correct in dismissing the bill because the bridge was lawful, plaintiff's rights were not infringed, and none of plaintiff's land was appropriated. (Duss-Florida)
W71-01846

TWIN FALLS CANAL CO V AMERICAN FALLS RESERVOIR DIST NO 2 (DIVERSION OF UNAPPROPRIATED WATER).

59 F2d 19-25 (9th Cir 1932).

Descriptors: *Idaho, *Diversion, *Use rates, *Unappropriated water, Dams, Prior appropriation, Beneficial use, Diversion structures, Relative rights, Water utilization, Usufructuary right, Compensation, Legal aspects, Judicial decisions.

Plaintiff canal company constructed and operated a dam in the Snake River. The United States constructed a dam upstream from plaintiff's dam. Defendant reservoir district, under contract with the United States, diverted water for irrigation from the slack water between the two dams. Plaintiff contended that were it not for plaintiff's dam, the level of the slack water between the dams would be too low to allow effective diversion. Plaintiff sought to force defendant to compensate plaintiff for the use of plaintiff's dam. The court, in affirming a judgment for defendant, found that plaintiff's right to the water extended only to its beneficial use at the dam. The right to use unappropriated water remained in the upstream proprietors. (Dye-Florida)
W71-01861

BIRCH V BOSTON AND M RR (LIABILITY FOR FLOOD DAMAGE CAUSED BY OVERFLOW OF DRAINAGE DITCH).
259 Mass 528, 156 NE 859-861 (1926).

Descriptors: *Massachusetts, *Flood damage, *Surface drainage, *Obstruction to flow, Ditches, Overflow, Water injury, Surface runoff, Surface waters, Cities, Railroads, Embankments, Drainage, Drains, Culverts, Saw mills, Millponds, Settlement (Structural), Subsidence, Legal aspects, Judicial decisions.

Plaintiff sawmill owner sued to compel defendant railroad to repair a drainage ditch and culvert and also sought to recover for damages caused by the overflow of the ditch after heavy rains. Plaintiff contended that the ditch was obstructed with silt, that it was too small, that the culvert was overgrown with grass and weeds and was even smaller than the ditch, and that both were insufficient to carry off the natural drainage of surface waters flowing into them. Defendant contended that the damage was due to plaintiff's neglect in not repairing the damage to his buildings and to increased flow of surface water from streets constructed by a nearby city. Affirming a judgment for plaintiff, the court held that, regardless of the source of the drainage water, it was the presence of defendant's inadequate ditch and culvert which caused the overflow and damage since it was not shown that the water from the city would have reached plaintiff's land but for defendant's ditch. The court also noted that defendant's liability could be abated by plaintiff's failure to make repairs. (Liptak-Florida)
W71-01871

BELCASTRO V NORRIS (DRAINAGE RIGHTS ACROSS ADJOINING PROPERTY).
261 Mass 174, 158 NE 535-536 (1927).

Descriptors: *Massachusetts, *Surface drainage, *Surface waters, *Relative rights, Ditches, Flow, Discharge (Water), Construction, Overflow, Surface runoff, Excavation, Damages, Land tenure, Riparian rights, Riparian land, Riparian waters, Watercourses (Legal), Legal aspects, Judicial decisions.

Plaintiffs sought to restrain defendant adjoining landowner from enlarging a ditch and to recover damages which resulted from the increased flow of water across their land occasioned by defendant's enlarged ditch. The trial court dismissed plaintiffs' bill, but the Supreme Judicial court of Massachusetts reversed. A landowner has the right to improve his land, and he is not responsible for damage caused by the natural flow of surface water incident to such improvement. However, a landowner cannot collect surface water into a ditch or artificial channel and discharge it on his neighbor's land. Plaintiffs were subject to the servitude of water running from ditches already constructed, but they could not be subjected to the servitude of an additional flow of water resulting in damage caused by construction of new and auxiliary ditches. Defendant could not drain his land by additional ditches if it increased the flow of water to plaintiffs' injury. Since exact damages could not be determined, plaintiffs were entitled to the injunction and nominal damages. (Duss-Florida)
W71-01873

HOGAN V PENNSYLVANIA RR (ALLEGEDLY INADEQUATE CONDUIT NOT PROXIMATE CAUSE OF FLOODING).
319 Pa 485, 181 A 447-448 (Pa 1935).

Descriptors: *Pennsylvania, *Conduits, *Railroads, *Backwater, Obstruction to flow, Topography, Discharge (Water), Watercourses (Legal), Damages, Runoff, Overflow, Natural flow, Culverts, Right-of-way, Flooding, Floodwater, Legal aspects, Judicial decisions.
Identifiers: *Causation (Legal).

Plaintiff landowner brought action against defendant railroad for damages to her property. The damage was allegedly caused by defendant's failure to maintain an adequate and unobstructed conduit under its tracks for discharge of waters from a natural watercourse. Defendant contended it was a physical impossibility for the flooding of plaintiff's land to have been caused by the inadequate conduit. The court found that the level of plaintiff's land was several feet higher than the level of the conduit and that, even if the passage of the conduit were completely obstructed, the water would not have flooded plaintiff's property. The water would have flowed over the conduit and into a nearby creek. For this reason the lower court's judgment of nonsuit was affirmed. (Price-Florida)
W71-01874

NATIONAL REAL ESTATE DEV CORP V LA VALE WATER CO (WATER RIGHTS AS EASEMENTS).

173 A 52-54 (Md 1934).

Descriptors: *Maryland, *Water rights, *Easements, *Land tenure, Reservoirs, Basins, Dams, Construction, Water utilization, Water supply, Conduits, Overflow, Springs, Pipes, Legal aspects, Judicial decisions, Adjudication procedure, Watercourses (Legal), Remedies.

Plaintiff corporation sued defendant water company in ejectment to recover alleged water rights. Both plaintiff and defendant had received deeds from a common grantor which conveyed water rights on a tract of land. The trial court granted defendant's motion for a directed verdict. The Court of Appeals of Maryland affirmed. Both deeds to plaintiff and defendant conveyed only certain water rights and privileges, and such rights and privileges were only easements. Therefore, if any rights of plaintiff were invaded, its remedy was an action on the case and not in ejectment. (Duss-Florida)
W71-01876

VOLUNTARY PRIVATE BEHAVIOR AS A MEANS TO REDUCE CONSUMER HEALTH HAZARDS AND ENVIRONMENTAL POLLUTION,
Brookings Institution, Washington, D.C.
For primary bibliographic entry see Field 05G.
W71-01880

FIDELITY UNION TRUST CO V COCHRANE (RIGHT TO USE OF PRIVATE LAKE).

172 A 800-803 (NJ 1934).

Descriptors: *New Jersey, *Easements, *Lakes, *Land tenure, Relative rights, Riparian land, Riparian water, Riparian rights, Ponds, Recreation, Public benefits, Judicial decisions, Legal aspects, Prescriptive rights, Public rights.

Plaintiff lake owner sought to enjoin defendant owners and occupants of summer cottages surrounding the lake from fishing, boating and bathing

in said lake. Defendant's claimed an easement of boating and bathing in the lake by adverse user of their predecessor in title and themselves for twenty years or more. The court found that defendants had not occupied the land long enough to comply with the state's adverse possession laws. Also, defendants took no such rights through their predecessors since their predecessors had no such rights. The predecessors never intended to adversely possess the rights claimed by defendants. The court held that plaintiff was entitled to the injunction sought. (Price-Florida)
W71-01886

PUBLIC POLICY AND SHORELINE LANDOWNER BEHAVIOR,
North Carolina Water Resources Research Inst., Raleigh.
Raymond J. Burby, III, and Shirley F. Weiss.
Available from NTIS as PB-195 926, $3.00 in paper copy, $0.95 in microfiche. North Carolina Water Resources Research Institute Report No. 38, July 1970. 126 p, 18 tab, 2 fig, 29 ref, append. OWRR Project B-012-NC (5).

Descriptors: *Reservoirs, *Reservoir sites, Reservoir construction, *Land development, *Land use, *Land ownership, Land management, Watershed management, North Carolina.
Identifiers: *Land use policy.

New residential development in reservoir shoreline areas begins with the decision of a landowner to sell individual sites to recreation consumers or acreage tracts to residential developers. While this first step in the residential development process is primarily facilitative in urban areas, it assumes central importance in reservoir areas where many landowners become intimately involved in the production and sale of residential sites. Environmental deterioration in reservoir areas is in large part due to the inexperience of these landowners turned land developers. Utilizing field data from fifty-eight interviews with predevelopment landowners in five multipurpose reservoir areas in North Carolina, the empirical analyses demonstrate the existence of significant relationships between landowner characteristics and landowner decisional outcomes. Tests based on multiple discriminant analysis indicate that these relationships can be expressed in a manner suitable for field level planning. The individual discriminant programs were able to classify correctly between 79.3 percent of the observations in the case of holders versus all sellers and 91.3 percent in the case of parcel sellers versus all other landowner types. The results of the combined discriminant program strongly suggest that a single landowner model can be developed to predict landowners who are most likely to hold, sell lots, subdivide, or sell to a developer. The strategic variables isolated thus far for an operational model of shoreline land owner behavior are the following five, in order of importance: (1) income from the land; (2) occupational interest in real estate; (3) residence on the land; (4) annual personal income; and (5) purpose of acquisition. The present study thus provides a beginning of an operational planning methodology for guiding shoreline development in multipurpose reservoir areas.
W71-01888

LINDENMUTH V SAFE HARBOR WATER POWER CORP (EASEMENT FOR FLOODING CAUSED BY DAM CONSTRUCTION).

309 Pa 58, 163 A 159-163 (1932).

Descriptors: *Pennsylvania, *Dams, *Easements, *Flooding, Rivers, Lumbering, Design flood, Maximum probable flood, Overflow, Water supply, Submergence, Land tenure, Judicial decisions, Legal aspects, Water injury, Relative rights, Damsites, Trees.

Plaintiff landowner sought to enjoin defendant water power corporation from flooding his land and from cutting trees on his land. Plaintiff's predecessor in title had granted to defendant's predecessor an easement to overflow plaintiff's land upon construction of a dam. This grant, which inured to heirs and assigns, included all rights necessary for full enjoyment of the easement. Defendant's intermediate predecessors built a dam downriver from the site originally contemplated and cut some trees to prevent them from drifting downstream after the flooding and injuring the dam. Plaintiff contended that: (1) the easement was in gross, and therefore unassignable; (2) by the terms of the grant, it was unassignable; (3) building another dam downstream exhausted the easement; and (4) the easement did not include the right to remove trees. Determining that the easement was appurtenant to the dam and that the grant expressly permitted assignment, the court held that defendant owned the easement. The court further held that the agreement specified no particular damsite and that removal of the trees was reasonably necessary for full enjoyment of the easement. The lower court's decision for defendant was affirmed. (Hart-Fla)
W71-01924

RICHARDSON V TUMBRIDGE (NON-USE OF EASEMENT NOT TANTAMOUNT TO ABANDONMENT).
149 A 241-244 (Conn 1930).

Descriptors: *Connecticut, *Easements, *Drainage, *Ditches, Riddance (Legal aspects), Drainage practices, Dams, Drains, Tile drains, Obstruction to flow, Judicial decisions, Legal aspects, Streams.

Plaintiff landowner sought a judgment that his land was no longer subject to a drainage easement granted by his predecessor in title to defendant's predecessor in title. Plaintiff contended that nonuse of the right to build a drainage ditch was tantamount to abandonment of such right. Defendant, as well as his predecessor, had chosen for drainage to use a natural stream that flowed through both properties in lieu of constructing the ditch. The court held that mere non-use of a deed-created easement was insufficient to establish abandonment. Before abandonment can be established, the owner must act so as to evidence an intention to abandon the easement. Defendant's conduct was found not to be inconsistent with his right to make use of the easement. Judgment for defendant was affirmed. (Price-Florida)
W71-01928

BURKE V BOSTON AND M RR (RAILROAD'S LIABILITY FOR DEATHS CAUSED BY ROADBED WASHOUT).
134 A 574-581 (NH 1926).

Descriptors: *New Hampshire, *Railroads, *Washouts, *Surface runoff, Embankments, Accidents, Damages, Land subsidence, Roads, Highways, Cities, Road construction, Diversion, Surface waters, Ditches, Culverts, Reasonable use, Diversion structures, Legal aspects, Judicial decisions, Adjudication procedure, Surface drainage, Repulsion (Legal aspects), Riddance (Legal aspects).

Plaintiff administrators brought actions against defendant railroad to recover for the wrongful deaths of three of defendant's employees who were killed when defendant's roadbed washed out and collapsed, resulting in a train wreck. The roadbed had long been protected by a highway which acted as a dam and diverted surface water away from the roadbed. Plaintiffs contended that defendant was negligent in not taking precautions against changed conditions after the highway had been reconstructed and failing to provide for surface water which crossed the highway and washed out the roadbed. Defendant contended that it relied on the continued protection of the highway absent any notice that the changes in the highway changed the direction or flow of the surface runoff and absent any obvious indications that the highway's protection had ceased. The court noted that defendant could not rely on the continuation of the highway's gratuitous protection, but was only responsible to make reasonable inquiry into changed conditions. Finding the lower court erred in not submitting defendant's requested instruction on the reasonable care standard, the court reversed and remanded for new trials the judgments for plaintiffs. (Liptak-Florida)
W71-01949

NICHOLS V FERNALD (UNREASONABLE USE OF FIRST RIGHTS IN SPRING).
131 A 836-837 (NH 1926).

Descriptors: *New Hampshire, *Preferences (Water rights), *Reasonable use, *Water pollution, Water rights, Springs, Competing uses, Legal aspects, Judicial decisions, Land tenure, Water utilization, Water users, Diversion, Potable water, Water supply, Water pollution sources, Animal wastes (Wildlife), Wastes, Relative rights.

Plaintiff and defendant owned adjacent property. Defendant's predecessor, plaintiff's grantor, had reserved the first use of water from a spring on plaintiff's property. Plaintiff sued to restrain defendant from interfering with plaintiff's right to use the water. Plaintiff contended that defendant made unreasonable use of the spring by allowing his cattle to feed there and pollute the spring. Defendant contended that plaintiff had interfered with the first use of the water by covering the spring and also used water for purposes other than those allowed under the deed. The court noted that if plaintiff had interfered with the first use of the water, defendant still had no right to remove the cover from the spring or make unreasonable use of the water and cause pollution, but should have resorted to his legal remedies. Finding that plaintiff's uses of the spring were only negligible breaches of the covenants in the deed, the court affirmed the trial court's judgment for plaintiff. (Liptak-Fla)
W71-01953

LOUISVILLE AND NASHVILLE RR V MIDDLETON (LIABILITY FOR DAMAGE FROM OVERFLOW OF DRAINAGE WATER CAUSED BY ROAD CONSTRUCTION).
260 Ky 755, 86 SW2d 982-983 (1935).

Descriptors: *Kentucky, *Drainage water, *Flood damage, *Road construction, Railroads, Culverts, Drains, Ditches, Surface drainage, Local governments, Overflow, Water injury, Damages, Obstruction to flow, Roads, Highways, Sediments, Sediment control, Easements, Right-of-way, Legal aspects, Judicial decisions, Adjudication procedure.

Plaintiff landowner brought action against defendants railroad and county. The county had reconstructed a road and a culvert along the railroad's right-of-way, thereby causing water, sediment and debris to discharge onto plaintiff's adjoining property. Plaintiff contended that the drains and culvert were improperly constructed and maintained, resulting in damage to his property. The jury exonerated the county but found the railroad liable. Reversing a judgment for plaintiff, the court found that defendant railroad had no control over defendant county's method or manner of construction of the road or culvert and held that, even if the railroad did have such control, it could not be liable unless the county had first been found liable. (Liptak-Fla)
W71-01958

CHICAGO, ST L AND N O RR V HICKS (RAILROAD'S LIABILITY FOR FLOOD DAMAGE CAUSED BY ERODED EMBANKMENT).
249 Ky 578, 61 SW2d 37-41 (1933).

Descriptors: *Kentucky, *Embankments, *Washouts, *Damages, Water injury, Railroads,

Construction, Erosion, Cultivated lands, Compensation, Flood damage, Sedimentation, Drains, Ditches, Crop response, Obstruction to flow, Drainage water, Judicial decisions, Legal aspects, Remedies.

Plaintiff landowners brought an action against defendant railroad company to recover for flood damage to their crops. The damage was caused by defendant's embankment washing out and clogging plaintiffs' drainage ditches. Plaintiffs contended that the embankment was improperly constructed, could easily be repaired, and that they were entitled to maintain successive damage actions if the flooding continued. Defendant contended that the embankment was a permanent structure and that plaintiffs could only recover once. Reversing a judgment for plaintiffs, the court held that the lower court should have submitted to the jury the question of whether the embankment was a temporary or a permanent structure. The measure of recovery would differ depending upon the theory chosen. (Liptak-Florida)
W71-01963

DE KALB COUNTY V TENN ELEC POWER CO (LIABILITY FOR FLOOD DAMAGE CAUSED BY DAM OVERFLOW DURING UNPRECEDENTED FLOOD).
67 SW2d 555-561 (Tenn 1933).

Descriptors: *Tennessee, *Historic flood, *Dams, *Flood damage, Floods, Maximum probable flood, Floodgates, Local governments, Bridges, Damages, Water injury, Rivers, Washouts, Overflow, Flood control, Hydroelectric plants, Electric power industry, Judicial decisions, Legal aspects.

Plaintiff county brought action to recover for the destruction of a county bridge. The destruction was allegedly caused by defendant electric power company's negligent operation of its dam and floodgates during a heavy rainstorm and flood. Plaintiff contended that the damage resulted from defendant's release of excess floodwater. Defendant contended that there was no negligent operation of the dam and that the damage was caused by an unprecedented flood which defendant was not required to anticipate. Affirming a judgment for defendant, the court held that defendant had a right to pass flood waters through its gates at the same rate that it flowed into the dam pond. From the uncontradicted evidence, at no time during the flood did the pond level fall below normal. In fact, the water level rose over the top of the dam with all the floodgates open. The only reasonable conclusion was that there had been no negligence on defendant's part. (Liptak-Florida)
W71-01965

DEASON V SOUTHERN RY (DAMAGES FOR OBSTRUCTION TO DRAINAGE).
140 SE 575-581 (SC 1927).

Descriptors: *South Carolina, *Surface drainage, *Obstruction to flow, *Repulsion (Legal aspects), Surface water, Land tenure, Damages, Flow, Railroads, Ditches, Right-of-way, Surface runoff, Channels, Compensation, Reasonable use, Outlets, Drainage, Watercourses (Legal), Legal aspects, Judicial decisions, Ponds, Embankments, Natural flow, Prescriptive rights.

Plaintiff upper landowner sought damages from defendant railroad for preventing the flow of water from a pond on plaintiff's property. Defendant had allegedly, without adequate provision for drainage, erected an embankment and obstructed plaintiff's ditch. In affirming a judgment for plaintiff, the South Carolina Supreme Court held that surface water is a common enemy, and every landowner has the right to protect himself from it. However, one cannot protect himself by backing water onto another's land, thereby creating a nuisance. There was sufficient evidence for the jury to decide that a nuisance was created by the embankment and ditch fill. As to plaintiff's right to the ditch, it was clear it had been in existence longer than the required prescriptive period. On a petition for rehearing one judge dissented, pointing out that the obstruction complained of occurred long before plaintiff acquired title to the property. Any action based on defendant's negligent construction of the embankment could only have been brought by plaintiff's grantor. (Duss-Fla)
W71-02012

NIAGARA FALLS POWER CO V WATER POWER AND CONTROL COMM'N (RIGHTS OF STATE IN GRANTED LANDS).
237 App Div 216, 262 NYS 217-228 (1932).

Descriptors: *New York, *Dams, *Rates, *Diversion structures, Electric powerplants, Hydroelectric plants, Structures, Municipal water, Water utilization, Industrial water, Diversion tunnels, Industrial production, Damsites, Legal aspects, Judicial decisions, Governments, Legislation, Artificial use, Water users, Usufructuary right.

Petitioner power company sought to have respondent water power commission's determination of changes for petitioner's diversion of water reviewed. Petitioner contended that only those rates which were agreed to in its contract with the state were valid. Petitioner further contended that the state did not have title to such rights of diversion for which the state could charge rents because the state had conveyed such rights to it. Respondent contended that since the state had the right to retake previously granted submerged land and the rights connected with them for navigational purposes or the public welfare, it had the right to charge an equitable annual rent for the rights of diversion. Respondent further claimed that the contract between the state and petitioner allowed respondent to increase the rates if petitioner diverted water in excess of the maximum quantity allowed. The court held that while the state could not grant submerged land so as to divest itself of the title held in trust for the public, riparian rights could be severed from the land and conveyed separately. Therefore the court found that the state did not have either title or a proprietary interest in the right to divert water flowing over the granted land for which it could assess charges except as set forth in the terms of the grant. (Quesada-Florida)
W71-02038

SHANDALEE CAMP, INC V ROSENTHAL (OWNERSHIP OF BED NON-NAVIGABLE LAKE).
133 Misc 502, 233 NYS 11-16 (1929).

Descriptors: *New York, *Lakes, *Ownership of beds, *Riparian rights, Easements, Land tenure, Riparian land, Riparian waters, Relative rights, Boundaries (Property), Boundary disputes, Judicial decisions, Legal aspects, Watercourses (Legal).

Plaintiff sought to enjoin defendant from using a portion of a small, non-navigable, freshwater lake which was located within the boundary lines of his property. Defendant sought similar relief. Plaintiff contended that each owned that part of the lake as was described in their deeds as being within their boundary lines. Defendant contended that all who owned property abutting on the lake owned to the center of the lake irrespective of their boundary lines. The court said that the lake was subject to private ownership. However, the rule that adjoining proprietors are presumptively owners of the soil under the water to the center of the lake was not applicable. Plaintiff and defendant owned land not bounded by the lake but by lines within which portions of the lake were included. The principles of private ownership apply to the bed of a small lake as they do to any other land. The owner of a portion of a lake bed has exclusive rights of boating, bathing and fishing in the waters over it. The parties were granted injunctive relief accordingly. (Price-Florida)
W71-02039

STRONG V TRUSTEES OF FREEHOLDERS AND COMMONALTY (INTERPRETATION OF DEED CONVEYING UPLANDS AND LOWLANDS).
133 Misc Rep 165, 231 NYS 664-666 (1928).

Descriptors: *New York, *Contracts, *Boundary disputes, *Boundaries (Property), Right-of-way, Ownership of beds, Beaches, High water mark, Legal aspects, Judicial decisions, Land tenure, Real property, Adjudication procedure.

Plaintiff claimed certain lowlands and brought action to remove a cloud on the title thereto. The court found it necessary to interpret the contract by which plaintiff sold certain uplands. The court found that when plaintiff conveyed such uplands, he also included his title to the submerged land abutting the uplands, any rights of way appurtenant thereto, and all lowlands adjoining said premises. Therefore, the court held that plaintiff had conveyed all his rights, title and interests in the lowlands in question as well as the uplands. A judgment was rendered for defendants. (Price-Florida)
W71-02046

BENNETT V CUPINS (LIABILITY FOR DIVERSION OF SURFACE WATER).
132 Misc 556, 230 NYS 550-553 (1928).

Descriptors: *New York, *Damages, *Surface waters, *Diversion, Drainage, Drainage practices, Diversion structures, Diversion losses, Gravel, Relative rights, Judicial decisions, Legal aspects, Landfills, Grading, Surface runoff.

Plaintiff landowner brought action for damages and sought an injunction against defendant's diversion of surface waters over her property. Defendant's adjoining land, previously servient to plaintiff's so far as regarded surface water drainage, was filled in so as to cause water to flow back onto plaintiff's property. Defendant, relying on case law, contended plaintiff had no remedy. The court distinguished the case relied on by defendant and held that plaintiff did have a cause of action. Plaintiff was entitled to the differences in the rental value caused by defendant's actions, special damages for cleaning by plaintiff, injunctive relief and permanent damages if the nuisance was not abated within a reasonable time. (Price-Florida)
W71-02058

ANTON V STANKE (UPPER PROPRIETOR'S LIABILITY FOR DAMAGE CAUSED BY HIS DIVERSION OF DRAINAGE WATER).
251 NW 153-157 (Iowa 1933).

Descriptors: *Iowa, *Riddance (Legal aspects), *Drainage effects, *Runoff, Discharge (Water), Diversion, Land management, Damages, Remedies, Legal aspects, Judicial decisions, Culverts, Natural flow doctrine, Drainage systems, Relative rights, Highways.

Plaintiff landowner sought to enjoin defendant upper landowner from diverting the drainage runoff from defendant's land into a highway drainage system which flowed by plaintiff's land. Plaintiff contended that defendant was diverting the runoff from its natural course and channeling it through the highway culvert onto plaintiff's land. Plaintiff maintained that defendant's actions resulted in an increase in the amount of water carried by the highway drainage system and that this increase was the cause of the system's overflow which damaged his land. Defendant contended that he was not diverting the groundwater from its natural course. He denied that he made any changes and claimed that upper landowners had a right to unobstructed natural runoff from their land. The Supreme Court of Iowa held that while upper landowners may drain their lands through natural watercourses so as to increase flow over servient lands, this increase cannot be in such an unnatural quantity as would damage other lands. (Quesada-Florida)
W71-02065

HERMAN V DREW (LANDOWNER MAY NOT INTERFERE WITH HIGHWAY DRAINAGE SYSTEM WHICH FOLLOWS THE NATURAL COURSE OF LAND'S DRAINAGE).
249 NW 277-278 (Iowa 1933).

Descriptors: *Iowa, *Surface runoff, *Drainage systems, *Repulsion (Legal aspects), Drainage engineering, Governments, Dams, Ditches, Topography, Paving, Surface waters, Natural flow, Obstruction to flow, Relative rights, Legal aspects, Judicial decisions, Highways, Highway effects, Road construction, Roadbanks.

Plaintiff township trustees sought to enjoin defendant landowner from maintaining a dam across the boundary of his land. The dam prevented runoff from plaintiff's highway from flowing onto defendant's land. This caused the runoff to back up onto the highway. Plaintiff contended that it had maintained the highway and its adjoining drainage systems for over twenty years and further contended that the drainage system followed the natural drainage flow of the land. Therefore, defendant could not obstruct the flow. Defendant contended that such drainage was damaging his land and that it altered the natural flow of the draining water. The Supreme Court of Iowa held that defendant could not interfere with the plaintiff's drainage system since it simply maintained the natural course of the land's drainage. (Quesada-Florida)
W71-02072

SIMONSON V ALDEN TOWNSHIP (LIABILITY FOR DRAINAGE OF SURFACE WATER).
231 NW 921-922 (Minn 1930).

Descriptors: *Minnesota, *Surface drainage, *Reasonable use, *Damages, Surface runoff, Discharge (Water), Watercourses (Legal), Relative rights, Highways, Swamps, Drainage, Land, Land tenure, Cities, Tile drains, Overlying proprietor.
Identifiers: Alden (Minn).

Plaintiff sought an injunction restraining defendants from discharging surface water from the land of defendant upper landowner onto plaintiff's land. Defendants township and upper landowner constructed a tile drain to drain the landowner's swamp so that the water flowed upon plaintiff's lands. Plaintiff admitted that defendant, as upper landowner, had the right to discharge surface water from his land, but contended that construction of the drain from the swamp was unreasonable. The trial court ruled for plaintiff and found that his land would be permanently damaged if the flooding were continued. The Supreme Court of Minnesota stated that an upper proprietor may not unreasonably gather water and cast it upon lower lands in destructive quantities. The question of reasonablenesss is a fact question, and the court held that the evidence justified the trial court's judgment for plaintiff. (Duss-Florida)
W71-02077

THOMPSON V BOARD OF SUPERVISORS (RELIEF FROM ADMINISTRATIVE RULINGS).

206 NW 624-627 (Iowa 1925).

Descriptors: *Iowa, *Drainage districts, *Administrative decisions, *Surface drainage, Administrative agencies, Discharge (Water), Drains, Surface waters, Outlets, Watersheds (Basins), Public benefits, Legislation, Topography, Drainage practices, Channel morphology, Judicial decisions, Legal aspects, Assessments.

Plaintiffs appealed a ruling of defendant board that plaintiffs' property be included in an expansion of a drainage district. Plaintiff contended such inclusion was arbitrary and not justified under the relevant statute since their lands would be benefited by the expansion. From a judgment for plaintiffs reversing its order, defendant appealed. Defendant's main contention was that the trial court lacked jurisdiction since the board's procedure which plaintiffs attacked was legislative, and there was no right of appeal provided in such procedure. Citing case law, the court held that plaintiffs had a right to appeal the order and to try de novo the fact question of whether their lands would be benefited by the proposed improvement. The court also stated that a landowner may freely avail himself of the topography of his land and discharge his surface water wherever gravitation naturally carries it without further concern on his part as to where it goes. The judgment for plaintiffs was affirmed. (Price-Florida)
W71-02078

DAVIS V HAINES (ISLAND OWNER OWNS ACCRETIONS TO THE ISLAND).
349 Ill 622, 182 NE 718-722 (1932).

Descriptors: *Illinois, *Islands, *Accretion (Legal aspects), *Riparian rights, Legal aspects, Judicial decisions, Remedies, Mississippi River, Navigable rivers, Boundaries (Property), Ownership of beds, Riparian waters, Riparian land, Pastures, Low flow, Water level fluctuations, Underwater, Real property, Land tenure.
Identifiers: *Towheads.

Plaintiff sought to quiet title to a towhead in the Mississippi River and to eject defendants therefrom as trespassers. Plaintiff claimed to be the owner, through adverse possession, of an island to which the towhead was connected at low water. Consequently, plaintiff also claimed ownership of the towhead. Defendants countered that they owned the towhead by virtue of quitclaim deeds accompanying their purchase of riparian land east of the river. The Supreme Court of Illinois reversed a lower court decision for defendants, finding that plaintiff had used the towhead for pasturage and cutting of willows and that such acts constituted adverse possession. Further, the court held plaintiff was owner of the towhead through accretion to the island. The rule that a riparian owner owns to midstream applies so that an owner of an island owns to midstream on both sides of the island. (Morris-Florida)
W71-02084

BENNETT V CUPINA (LIABILITY OF LANDOWNER FOR ALTERING GRADE OF LAND).

253 NY 436, 171 NE 698-699 (1930).

Descriptors: *New York, *Surface runoff, *Riddance (Legal aspects), *Grading, Water control, Legal aspects, Judicial decisions, Remedies, Damages, Surface drainage, Slopes, Surface waters, Repulsion (Legal aspects), Watercourse (Legal), Artificial watercourses, Relative rights, Land use, Land management.

Plaintiff sought damages and an injunction to require defendant adjacent landowners' removal of a driveway which caused surface water to flow on plaintiff's land. Plaintiff's land originally was higher than defendants', and surface water flowed onto defendants' property. Predecessors of defendants, however, filled the land in and graded it for erection of a schoolhouse. Defendants contended that since the improvements to their land did not create or alter a definite watercourse, they could not be held liable. The New York Court of Appeals reversed a lower court decision for plaintiff. Any owner may change the natural contour of his land, and as long as he does not create or alter a defined watercourse, any resulting damage does not give rise to a cause of action. (Morris-Florida)
W71-02086

STATE V FORSYTH (TITLE TO LAND CREATED BY RELICTION).
162 NE 661-663 (Ind 1928).

Descriptors: *Indiana, *Accretion (Legal aspects), *Land tenure, *Boundaries (Property), Boundary disputes, Riparian land, Lakes, Water level fluctuations, Riparian rights, Swamps, Lake stages, Nonnavigable waters, United States, Patents, Governments, Surveys, Mapping, Remedies, Judicial decisions, Legal aspects.
Identifiers: Reliction.

Plaintiff state sought to quiet title to certain land created by the recession of a lake. Title to the lake and its bed had been given to the state by the United States. Certain areas bordering closely on the lake were subsequently patented by the state to defendant's predecessor. Plaintiff claimed that its grants were not intended to make the grantees riparian owners. The court found that the grants did make the grantees riparian owners and as such the owners of land created by the recession of the water in the lake. (Barker-Florida)
W71-02087

COLE V PITTSBURGH AND L E RR (LOCATION OF BOUNDARY ON NON-NAVIGABLE STREAM).

162 A 712-717 (Pa 1932).

Descriptors: *Pennsylvania, *Banks, *Boundary disputes, *Boundaries (Property), High water mark, Low water mark, River beds, Ownership of beds, Legal aspects, Judicial decisions, Streambeds, Navigable waters, Railroads, Bridges, Streams, Relative rights, Non-navigable waters, Real property.

Plaintiff riparian landowner brought an action in ejectment against defendant railroad compnay, contending that he was the rightful owner of the land which lay between his riparian land and the low water mark of the river which formed a boundary of his land. Plaintiff contended that since his vendor described the boundary in question as 'along the banks' and that since his vendor owned, at the time of the conveyance, two-thirds of the bed of the river whose banks were to form the boundary, the vendor had intended to convey the land to him all the way out to the low water mark. Defendant, who later acquired the land in question from plaintiff's vendor, contended that the vendor had only conveyed to plaintiff the riparian land to the banks. Defendant contended that the words 'along the banks' meant those boundaries which contain the water at the points of its highest flow. The Supreme Court of Pennsylvania agreed with defendant's interpretation of the terms of the deed and held that the vendor conveyed land only to the banks of the river to plaintiff. The court stated that the presumption that a grantor of land bounded by a stream intends the boundary to extend to the stream is rebuttable, and the vendor's use of 'along the banks' as the description of the boundary was sufficient to rebut the presumed intent. Consequently, defendant was the rightful owner of the land from the banks to the low water mark. (Quesada-Florida)
W71-02089

MASONITE CORP V HILL (POLLUTION VICTIM MUST PROVE CERTAIN POLLUTANT CAUSED INJURY).
154 So 295-299 (Miss 1934).

Descriptors: *Mississippi, *Pollutant identification, *Water pollution effects, *Industrial wastes, Legal aspects, Judicial decisions, Recreation, Damages, Water sports, Water pollution, Fishkill, Water pollution sources, Effluents, Oxygenation, Municipal wastes, Water analysis, Pulp wastes, Chemical wastes, Alcohols, Streams, Downstream.

Defendant manufacturer of masonite emptied a very small percentage of poisonous methyl alcohol, and a few other chemicals, into a creek, causing unidentified chemical changes to take place. Fish died from lack of oxygen. At least two cities and several other industries also dumped effluent into the creek. Plaintiff bather sued defendant manufacturer of masonite for burns allegedly caused by defendant's pollution of the river in which plaintiff

waded. Defendant contended that plaintiff had not sufficiently proved the causal connection between defendant's effluent and plaintiff's injury. The Supreme Court of Mississippi, in reversing a lower court decision for plaintiff, held that the inferences relied on by plaintiff were extended too far. Plaintiff had not sufficiently met the burden of proving that defendant's plant's effluent caused the injury. Chemical analysis of the water would have been possible, and a series of inferences was not a satisfactory substitute. (Morris-Florida)
W71-02092

DAVIS V GARDEN HILLS CORP (PROPER MEASURE OF DAMAGES FOR POLLUTION OF STREAM).
148 SE 861-864 (Ga 1929).

Descriptors: *Georgia, *Water pollution, *Damages, *Profit, Sewage, Streams, Legal aspects, Judicial decisions, Impaired water quality, Local governments, Water pollution effects, Water pollution sources, Riparian rights, Downstream, Pollutants, Milk, Dairy industry, Cattle, Adjudication procedure, Land tenure.

Plaintiff dairy farmer sued for actual and punitive damages, alleging that defendant real estate developer had caused pollution of a stream and thereby reduced the profits of plaintiff's dairy business. Plaintiff alleged that he had spent money for cows and equipment for the leased property and that he had been operating at a profit before defendant built and sold houses on its property, draining sewage into a stream which flowed onto plaintiff's property and from which plaintiff's cows obtained water. The City of Atlanta health department told plaintiff to quit using the polluted water, thus forcing plaintiff to spend additional money to obtain water and reducing his profits. Defendant contended that plaintiff did not allege a proper measure of damages. The Georgia Court of Appeals held that since plaintiff was a tenant, the damage should be the difference in the value of the tenancy before and after the pollution, not the dimunition in profits. (Morris-Florida)
W71-02093

SOZANSKA V TOWN OF STRATFORD (DRAINAGE OF SURFACE WATER DISCHARGED FROM PUBLIC STREETS).
153 A 164-166 (Conn 1931).

Descriptors: *Connecticut, *Obstruction to flow, *Riparian rights, *Natural streams, Streams, Drainage, Highways, Relative rights, Public rights, Cities, Local governments, Surface waters, Diversion, Judicial decisions, Legal aspects, Streamflow, Grading, Surface drainage, Land, Surface runoff, Tile drainage, Ditches.
Identifiers: Stratford (Conn).

Plaintiff landowner's property contained a tile drain once used to channel the flow of a stream fed by a stream located on the other side of a public highway from plaintiff's land. A change in grade of the highway altered the course of the stream so that it no longer crossed plaintiff's land. For years since the change in course, the drain had been obstructed by accumulated soil. Defendant town entered plaintiff's land without his permission and sought to open the drain located in plaintiff's front yard. Plaintiff sought damages for trespass and an injunction. Defendant contended that the drain was the channel of a natural stream and that defendant, as an upstream riparian owner, was entitled to its unobstructed flow. In affirming the trial court's judgment for plaintiff, the court found that the alleged natural watercourse had ceased to exist, and thus defendant was no longer a riparian owner. The court further held that Connecticut statutes prohibited discharge of surface waters from public streets through or under the yard of any dwelling house. (Dye-Florida)
W71-02094

MARBA SEA BAY CORP V CLINTON STREET REALTY CORP (BOUNDARY DISPUTE RELATING TO HIGH WATER MARK).

272 NY 292, 5 NE2d 824-829 (1936).

Descriptors: *New York, *High water mark, *Seashores, *Boundary disputes, Legal aspects, Ownership of beds, Banks, Tidal waters, Low water mark, Judicial decisions, Public lands, Governments, Oceans, Land tenure.

Plaintiff corporation brought an action in partition against defendant realty corporation which had taken title from the state. Plaintiff contended that it had title through a colonial grant. Plaintiff argued that it owned all the waterfront property, including the foreshore, and was not limited by the high water mark. Defendant contended that such colonial grant was void because it was made to private persons for neither commercial nor governmental purposes and was thus against public policy. The New York Court of Appeals held for defendant. The colonial title was void as against public policy. It conveyed public lands for non-public purposes. Moreover, the court found that the deed, describing a boundary as 'bounded southerly by the Atlantic Ocean', conveyed title no further than the high water mark. This excluded the foreshore. (Quesada-Florida)
W71-02097

MONTANA POWER CO V ROCHESTER (OWNERSHIP OF LAND BETWEEN HIGH AND LOW WATER MARKS).
127 F2d 189-193 (9th Cir 1942).

Descriptors: *Montana, *Ownership of beds, *Patents, *Easements, Navigable waters, High water mark, Low water mark, Boundaries (Property), Boundary disputes, Dams, Reservoirs, Outlets, Lakes, Flooding, Relative rights, Right-of-way, Federal government, Legislation, Judicial decisions, Legal aspects, United States.

Plaintiff owned an island in a lake. The island was connected to the shore by a bar. The owner of the lot where the bar met the shore had granted plaintiff an easement over his lot and the bar. Defendant power company had, with the permission of the Federal Power Commission, flooded the bar. Plaintiff sought damages as such flooding made her island inaccessible except by boat. Plaintiff contended that the owner of the shore lot owned to the low water mark and had title to the bar and that she was entitled to damages for the destruction of her easement. Defendant contended that the shore lot owner held title only to the high water mark, that the United States held title to the bar as part of the lake bed, and that the lot owner had no right to grant the easement now claimed by plaintiff. The court held that the general rule is that United States' patents to lands bordering on navigable waters convey title only to the high water mark. The area between the high and low water marks should be in the sovereign. Consequently, plaintiff's easement was improperly granted, and the trial court's judgment for plaintiff was reversed. (Price-Florida)
W71-02098

RICHARD T GREEN CO V CITY OF CHELSEA (TAXATION OF REAL PROPERTY ON NAVIGABLE WATERS).
149 F2d 927-932 (1st Cir 1945).

Descriptors: *Massachusetts, *United States, *Real property, *Taxes, Judicial decisions, Legal aspects, Legislation, Navigable waters, Federal government, Assessments, Low water mark, Cities, Local governments, Docks.

The United States took certain waterfront land under its power of eminent domain. The questions involved in the instant case were whether certain tax liens asserted by plaintiff city against the land were valid, whether a marine railway which was located on the land was real or personal property, and whether the entire railway, part of which extended below the low water mark, was taxable as realty. The court held that the fact that the license for construction of the railway extended only to the low water mark was not conclusive in construing the machinery to be personal property even though Massachusetts law indicated that private property in lands adjacent to navigable waters extends only to the low water mark. Although such license did not grant title to the real estate, there was no reason why the railway would not be assessed as real estate for purposes of taxation. The circuit court affirmed the district court's determination that under Massachusetts law, such a structure attached to the land was real estate and thus subject to taxation. (Barnett-Florida)
W71-02100

POINSETT LUMBER AND MFR CO V UNITED STATES (COMPENSATION FOR PHYSICAL INVASION OF PRIVATE PROPERTY BY GOVERNMENT PROJECTS).
91 Ct Cl 264-268 (1940).

Descriptors: *United States, *Compensation, *Levees, Flood control, *Arkansas, Legislation, Lumbering, Judicial decisions, Legal aspects, Missouri, Federal government, Drainage districts, Drainage engineering, Construction, Flood protection, Dams, Diversion, Alteration of flow, Headwaters, Tributaries, Backwater, Beneficial use, Eminent domain, Flood damage.

Plaintiff lumber company owned timber lands situated along the banks of the St. Francis River in Arkansas. Defendant, pursuant to statute, entered upon the land for the purpose of establishing a new levee line in accordance with a plan of levee construction on the tributaries of that river. Plaintiff alleged that such planned construction would force the waters of the river over its lands resulting in the destruction of the standing timber thereon. The Court of Claims held that nothing had been done by defendant's engineer which would directly cause the diversion of water over the property in question. The construction work was found not to affect plaintiff's use or occupation of the lands. The court stated that in order to constitute a taking such as will entitle an owner to maintain a suit against the government for compensation, it must definitely appear that there has been an actual physical invasion or encroachment upon private property, or else such a direct physical destruction as to permanently dispossess the owner. (Barnett-Florida)
W71-02114

WATER SUPPLY AND WASTE WATER DISTRICTS IN SUBURBIA,
Myron K. Nelson, and R. L. Chandler.
In: Proceedings, American Society of Civil Engineers, Journal of the Sanitary Engineering Division, Vol 96, No SA2, p 593-604, April 1970. 5 fig, 1 tab.

Descriptors: *Water district, *Urbanization, *Management, *Water supply, Sewage treatment, Sewers, Water treatment, Sanitary engineering, Institutions, Administration.
Identifiers: *Suburbia, *Waste water treatment districts.

Formation of water and sewer districts in a highly urbanized area composed of fourteen separate cities are described. The water districts have encouraged the orderly development of this rapidly expanding area in the following ways: (1) The ability of the district to finance large major improvement projects when such improvements are needed; (2) the main extension policies of the District which assure recovery of the original investment or deposit by the developer through refunds after customers are connected to the mains; and (3) the practice of constantly studying and reviewing the projected needs of the District. The waste water districts use the following methods: (1) The

ability of the Districts to meet varying conditions of development; (2) the ability of the Districts to plan and finance on a major watershed basis; (3) one central administration for all Districts permits an economical operation as well as uniform rules, regulations, and other requirements; and (4) the ability of the Districts to finance enlargements of collection and treatment facilities by a resolution of the governing body without additional elections or petitions. (Davis-Chicago)
W71-02117

LOUISIANA DELTA CATTLE CO V UNITED STATES (LIABILITY FOR PROJECTED DAMAGES FROM PROPOSED IMPROVEMENT).

93 Ct Cl 662-666 (1941).

Descriptors: *Louisiana, *Flood control, *United States, *Compensation, Flood protection, Mississippi River, Judicial decisions, Legal aspects, Levees, Drainage, Precipitation excess, Federal government, Outlets, River flow, Eminent domain, Public rights, Damages, Remedies, Legislation, Condemnation, Flood damage, Water injury.

Plaintiff owned lands adjacent to the Mississippi River which were protected against flood or water submergence by public levees along the banks of the river. As a result, plaintiff's lands were arable, valuable and subject to easy drainage of intense rainfall. Defendant, pursuant to a plan under the Flood Control Act, selected a new set-back or levee line which plaintiff alleged would cause all flood protection to be withdrawn, allowing the river to overflow and damage its land. Plaintiff sought to recover the value of the land as a result of these acts. The court held that plaintiff was not entitled to recover where there was no allegation in its petition of a past or consummated innundation or damage and where the damage alleged was prospective upon the abandonment or removal of the previous levees. The court held that the mere fact that the value of the property was injured or affected by some act which the government proposed to do in the future did not establish a 'taking' within the meaning of the fifth amendment. (Barnett-Florida)
W71-02118

ANDERSON V REAMES (RIPARIAN RIGHTS OF LAKE PROPERTY OWNER)
161 SW2d 957-961 (Ark 1942).

Descriptors: *Arkansas, *Riparian land, *Riparian rights, *Public rights, Remedies, Reasonable use, Banks, High water mark, Low water mark, Legal aspects, Judicial decisions, Docks, Piers, Boats, Recreation, Boat-launching ramps, relative rights, Land use, Lakes, Lake shores.

Plaintiff fish camp operators sought an injunction to force defendant riparian lessees to allow plaintiffs' customers onto certain riparian land. Plaintiffs contended that by reason of the fact that the lake was navigable, they, as members of the public, had the right to operate a commercial boat dock and use the shore in the conduct of their business. Defendants contended that the right to operate a dock and use the banks was a riparian right belonging to the owner of the riparian land, which was properly leased to them. While holding that plaintiffs' structures had to be removed from defendants' lands, the Supreme Court of Arkansas also delineated the following rights of a riparian landowner and of a member of the public: (1) the riparian owner has use and control of his land to the high water mark; (2) the only right that a riparian owner has over the rights of the general public is the right to free ingress and egress to his property along its edge; (3) the riparian rights of an owner include access to the water, the right to build a pier to the line of navigability, and the right to accretion and reasonable use of the water; and (4) no private person can claim an exclusive right to fish in navigable water. (Quesada-Florida)
W71-02119

FARRAR V SHUSS (RIGHTS OF SERVIENT LANDOWNER TO PREVENT FLOW OF SURFACE WATER ONTO HIS PROPERTY).
282 SW 512-515 (Mo 1926).

Descriptors: *Missouri, *Impounded waters, *Surface waters, *Repulsion (Legal aspects), Diversion, Flooding, Floodwater, Drainage, Discharge (Water), Impoundments, Reservoirs, Dams, Overflow, Surface runoff, Backwater, Diversion structures, Easements, Judicial decisions, Legal aspects, Flood damage, Damages.

Plaintiff landowner sought damages for injury to his property allegedly caused by the collection of surface water behind defendant's reservoir and by the negligent maintenance of said reservoir which caused the water to be released with force on plaintiff's land. Defendant demurred to plaintiff's allegations. The court stated that in order to recover for the discharge of surface water upon the land of another, some negligence must be shown. The court found that defendant was negligent in the construction or maintenance of the reservoir. Defendant had no right to dam up the water and throw it back with destructive force onto plaintiff's land. The owner of a servient estate may erect obstructions to prevent surface water from coming onto his land and in this manner throw water back on the dominant estate without incurring liability. The court held, however, that defendant had collected the water which caused plaintiff's injury and did not act simply to prevent such water from coming onto his property. The trial court's judgment for defendant was reversed. (Price-Florida)
W71-02124

KILGO V COOK (OWNERSHIP OF BEDS OF NON-NAVIGABLE STREAMS).
295 SW 355-357 (Ark 1927).

Descriptors: *Arkansas, *Boundary disputes, *Ownership of beds, *Meanders, Streams, Rivers, Real property, Boundaries (Property), Banks, Beds, Legal aspects, Judicial decisions, Shores, Navigable waters, Navigable rivers, Running water, River beds, Riparian rights, Riparian land, Nonnavigable waters, Recreation, Lakes, Streambeds.

Properties of plaintiff and defendant were originally part of a single grant. The government survey of the original grant took no notice of a nonnavigable stream which ran through the property. The description in plaintiff's deed extended his property to the east bank of the stream, including the streambed. Defendant's property, across the stream, was also bounded by the east bank. Plaintiff sought to quiet title in the streambed and to restrain defendant from trespassing thereon. Defendant claimed to be a riparian owner, and as such the owner to the thread of the stream. The Supreme Court of Arkansas reversed a judgment for defendant. Although owners of land bordering a meandered non-navigable stream take title to the center of the stream, where property was surveyed as land and the streams therein were not meandered, the owner of the land may dispose of it in the manner of his choosing, even to the exclusion of some grantees' riparian ownership. In the instant case the stream in question was not meandered. Since defendant took title with notice of the prior grant of the streambed to plaintiff, he could not later claim to be a riparian owner. (Dye-Florida)
W71-02125

DUGAN V LONG (LIABILITY FOR DIVERSION OF NATURAL FLOW OF SURFACE WATER).
234 Ky 511, 28 SW2d 765-767 (1930).

Descriptors: *Kentucky, *Surface waters, *Natural flow, *Landfills, Landscaping, Ponding, Rain, Flooding, Canals, Culverts, Judicial decisions, Legal aspects, Construction, Grading, Obstruction to flow, Pipes, Septic tanks, Overlying proprietor, Easements, Impoundments, Drainage, Adjudication procedure, Damages, Flood damage.

Plaintiff owned land adjacent to defendant. Defendant's land was situated lower than plaintiff's, and surface water in its natural course flowed from plaintiff's land on and across defendant's property. Defendant filled in and raised the grade of her lot, thereby obstructing the natural flow of surface water. This obstruction caused the water to accumulate and flood plaintiff's lot after every unusually heavy rainfall. Plaintiff sought to recover damages which resulted from such flooding. The court stated that a lower estate is subject to an easement of receiving the natural flow of surface water from an upper estate and that an owner of a lower estate has no right to create obstructions which interfere with such natural flow. However, the court ruled that since defendant's structure was permanent, there could be but one recovery for past, present, prospective or contingent damages. The action for such damages had to be brought within the applicable statute of limitations. Plaintiff failed to so bring his action and was therefore barred from recovery. (Barnett-Florida)
W71-02126

CITY OF COVINGTON V STATE TAX COMM'N (ASSESSMENT OF SUBMERGED LAND FOR TAXING PURPOSES).
231 Ky 606, 21 SW2d 1010-1018 (1929).

Descriptors: *Kentucky, *Boundaries (Property), *Taxes, *Beds under water, Bridges, Low water mark, Cities, Thalweg, Boundary disputes, Assessments, Judicial decisions, Legal aspects, State governments, Administrative agencies, Administration, Ohio, Tidal waters, Navigable waters, Banks, Riparian rights, Riparian land, Ownership of beds.
Identifiers: Covington (Kentucky).

Plaintiffs brought suit to enforce assessment of defendant city's land to collect taxes covering the cost of building bridges that serviced defendant municipal corporation. A dispute arose as to how much of defendant's land bordering on the Ohio River was in fact assessable for tax purposes. Plaintiff alleged that the corporate limits extended to the thread of the stream bounding defendant city. Defendant, relying on its charter and grant, alleged ownership in assessable lands extended solely to the low water mark of the river. The court stated that where deeds call for boundary line with physical dimensions, such as a road, street, stream or watercourse, individuals and municipal corporations own to the center of the physical line or thread of the stream, unless such boundary is a stream in which the tide ebbs and flows. There being no ebb or flow in the instant case, the court held that the assessable property extended to the center of the stream. (Barnett-Florida)
W71-02127

KERBY V PRAIRIE PIPE LINE CO (INJURY TO CATTLE CAUSED BY OIL POLLUTION OF WATER).

11 SW2d 758-759 (Mo 1928).

Descriptors: *Missouri, *Pipelines, *Oil, *Water pollution, Pollution sources, Cattle, Judicial decision, Legal aspects, Damages, Remedies, Surface waters, Streams, Dams, Water pollution effects, Water pollution sources, Adjudication procedure, Oil industry, Pollution.

Plaintiff owned land through which a stream flowed. Defendant corporation engaged in the transportation of crude petroleum. At a point above plaintiff's lands where defendant's pipes crossed the stream, the pipes burst, causing the oil to flow into the stream and subsequently onto plaintiff's lands. Defendant attempted to remove the oil from the stream by burning it and burying the excess slag in the banks of the stream. Plaintiff's cattle, grazing and watering in a portion of the stream, were injured as a result of drinking the polluted water. Plaintiff alleged that defendant's negligent maintenance of the pipeline had permitted the pipe to break. The court held that defen-

dant's demurrer should be sustained in that there was no evidence of negligence on the part of the defendant. (Barnett-Florida)
W71-02128

FORDSON COAL CO V PLEASNICK (LIABILITY FOR DAMAGE FROM OVERFLOW CAUSED BY EXTRAORDINARY RAINS).
215 Ky 794, 287 SW 11-12 (1926).

Descriptors: *Historic flood, *Kentucky, *Floods, *Flood damage, Flood control, Maximum probable flood, Design flow, Discharge (Water), Flood protection, Floodwater, Overflow, Rain, Rain water, River flow, Streamflow, Streams, Storm runoff, Bridges, Bridge construction, Legal aspects, Judicial decisions, Excess precipitation.

Plaintiff purchased a tract of land immediately above a railroad bridge which was erected across a stream. Defendant coal company then constructed two bridges across the stream immediately below the railroad bridge. Subsequent to such construction, a flood occurred which damaged plaintiff's property. Plaintiff brought an action for damages upon the theory that defendant had negligently constructed its bridge across the stream, thereby obstructing the natural flow of the water from ordinary rainfall and causing the stream to overflow. Witnesses testified at the trail that the rains and flood were unusual and extraordinary. The Kentucky Court of Appeals reversed the trial court's judgment for plaintiff. The court held that one constructing a bridge over a stream is not liable for damages from overflows caused by such extraordinary rains or floods as could not have been anticipated. (Powell-Florida)
W71-02129

CHESAPEAKE AND O RY V RICE (LIABILITY FOR DAMAGE TO LAND FROM DRAIN OBSTRUCTION).
221 Ky 695, 299 SW 565 (1927).

Descriptors: *Kentucky, *Alteration of flow, *Obstruction to flow, *Diversion, Water rights, Railroads, Drains, Legal aspects, Judicial decisions, Ditches, Surface water, Drainage water, Surface drainage, Right-of-way, Watercourses (Legal), Natural flow, Diversion structures, Adjudication procedure.

Plaintiff owned property that abutted defendant railroad's right-of-way. Defendant constructed a ditch along its right-of-way and diverted water into the ditch which formerly flowed in an opposite direction. Plaintiff brought an action for damages which resulted from such changes in the natural flow. Plaintiff alleged that the ditch was not of sufficient size to allow proper drainage and that in times of ordinary rainfall water flowed and stood upon plaintiff's property. Plaintiff further alleged that defendant was negligent in permitting the ditch to become obstructed. Witnesses at the trial failed to give any estimate of the value of the property destroyed or any estimate of the diminution in the value of the use of the property caused by the overflow. The Court of Appeals of Kentucky reversed the lower court's judgment for plaintiff. The court held that the verdict against defendant railroad was excessive because of the vagueness and uncertainty of the evidence supporting it. (Powell-Florida)
W71-02130

WINCHESTER WATER WORKS CO V HOLLIDAY (WATER COMPANY'S LIABILITY FOR DAMAGES RESULTING FROM BUILDING OF A FLASHBOARD DAM).
241 Ky 762, 45 SW2d 9-11 (1932).

Descriptors: *Kentucky, *Reservoirs, *Dam failure, *Flooding, Public utilities, Dams, Flood control, Damages, Remedies, Crops, Farms, Judicial decisions, Legal aspects, Lakes, Streams, Surface waters, Spillways, Surplus water, Impounded waters, Construction, Natural flow, Rainfall.

Plaintiff landowners sued defendant water company for damages from a flood caused by the breaking of a flash dam built and operated by defendant. Defendant had built two artificial lakes as reservoirs. One of these lakes was created by building a dam across an existing creek. To increase the impoundment of waters behind the dam in the dry season, defendant built a temporary flashboard dam across the top of the permanent dam, thereby increasing the dam's height by fifteen inches. Plaintiffs alleged that defendant's negligent construction of the flashboard dam was the cause of the flooding to their property. Defendant contended that the dam was not negligently built, but was intended to wash-out at times of heavy rainfall. The court found no evidence of negligence but held that defendant, as an upper proprietor had no right to impound waters and then to release them suddenly upon the lands of lower proprietors. Defendant could not, without liability construct a device that would give way automatically during a flood. (Barnett-Fla)
W71-02131

BOARD OF TRUSTEES OF TOWN OF AUBURN V CHYLE (CITY NOT LIABLE FOR FLOODING CAUSED BY STREET DRAINAGE).
256 Ky 283, 75 SW2d 1039-1041 (1934).

Descriptors: *Kentucky, *Surface runoff, *Riddance (Legal aspects), *Road construction, Roads, Drains, Sewers, Water injury, Flooding, Cities, Local governments, Surface waters, Natural flow, Rainfall, Rain water, Runoff, Grading, Drainage water, Judicial decisions, Legal aspects, Damages.
Identifiers: Auburn (Kentucky).

Plaintiff landowner brought action to recover damages caused by defendant city's alleged negligence in repairing streets and drains. As a result of the negligence, plaintiff's property was flooded when it rained. Plaintiff contended that defendant had a duty to maintain its streets and drains so as not to collect and discharge surface water onto landowners' property. Defendant contended that plaintiff's property had always flooded when it rained and that the street repairs did not change the natural flow of surface water. Reversing a judgment for plaintiff, the court held that plaintiff had failed to show that defendant's street repairs had changed natural conditions and caused flooding. The court noted that landowners are subject to the natural flow and drainage of surface water and could not complain unless the quantity or direction of flow had been changed by another. (Liptak-Fla)
W71-02132

BABER V GRIGGS (LIABILITY FOR DIVERTING SURFACE WATER FROM ROADWAY ONTO ADJACENT LAND).

252 Ky 816, 68 SW2d 419-421 (1934).

Descriptors: *Kentucky, *Roadbanks, *Surface runoff, *Repulsion (Legal aspects), Roads, Erosion control, Grading, Highways, Road construction, Slopes, Road design, Access routes, Diversion, Diversion structures, Drainage water, Drainage effects, Surface waters, Judicial decisions, Washouts, Adjudication procedure.

Plaintiff and defendant owned adjoining farms. Defendant's only means of ingress and egress was a small road through plaintiff's property to the public highway. Plaintiff brought a damage action claiming that defendant had built elevations in the road and thus diverted drainage water from the road onto plaintiff's land. Defendant contended that he had only repaired the elevations which were built 15 years before along with the road, that without them the road would wash out and be useless, and that plaintiff was precluded from complaining of the elevations because of their existence and repeated repair for so many years. The court affirmed a judgment for defendant, finding no error in the lower court's rulings or jury instructions. (Liptak-Fla)
W71-02133

CHAPTER VII: POLITICAL AND INSTITUTIONAL ASPECTS OF THE EVALUATION OF WATER RESOURCE PROGRAMS.
For primary bibliographic entry see Field 06B.
W71-02137

KELLEY ISLAND LIME AND TRANSPORT CO V CITY OF CLEVELAND (LIABILITY FOR OBSTRUCTION OF NAVIGABLE WATERCOURSES).
47 F Supp 533-545 (ND Ohio 1942).

Descriptors: *Ohio, *Admiralty, *Navigable waters, *Remedies, Rivers, Construction, Bridges, Accidents, Contracts, Mechanical equipment, Obstruction to flow, Navigable rivers, Legislation, Damages, Judicial decisions, Legal aspects, Navigation, Ships, Highways, Cities.
Identifiers: *Obstruction to navigation.

Libel was brought against the City of Cleveland for negligently obstructing a navigable waterway within its city limits. Libelant ship was lawfully navigating a river when it struck a hidden obstruction in the river and sank. Libelant alleged that libelee city was charged by statute to keep the highways free of obstruction and that since a navigable river was a public highway, libelee should be liable. The court rejected this claim and found that a navigable river was not a public highway within the meaning of the statute. However, the court held that libelee could be held liable because, while engaged in its statutory function of caring for bridges, aqueducts, and viaducts, it caused an obstruction to be placed in the river and left it there without properly marking it. The mere placing of an obstruction in a navigable stream without warning in and of itself constituted negligence and gave rise to liability for the resulting injury to libelant. (Barnett-Fla)
W71-02142

METROPOLITAN PLANNING AND IMPLEMENTATION,
Metropolitan Council of the Twin Cities, Minn.
Robert C. Einsweiler.
Proceedings, American Society of Civil Engineers, Journal of the Urban Planning and Development Division, Vol 96, No UP2, p 113-121, October 1970. 2 fig.

Descriptors: *Planning, *Governments, City planning, Land use, Administration, Inter-agency cooperation.
Identifiers: *Metropolitan planning, Public policy, *Implementation, Policy, Professional practice.

Governmental decision-making in metropolitan areas is gravitating toward more comprehensive, area-wide, policy-oriented organizations and creating new roles for engineers. The new Metropolitan Council has its roots in the Minneapolis-Saint Paul Sanitary District created in 1933. The Council represents an evolution in geographic scope from two central cities to seven counties; and in method of representation from local elected officials to metropolitan district representatives. In authority, it combines regional planning with operating subordinate boards, the successors to independent metropolitan authorities. In the process, the role of the engineer has changed. He now participates as a member of a multidiscipline team in recommending regional development policy to the Metropolitan Council and continues more typical engineering roles with subordinate boards in the design, construction and operation of metropolitan public works. Similar changes, though less advanced are occuring across the nation. Engineers should see this as an opportunity to improve the democratic process. The alternative of technocracy is not a professionally responsible approach. (Davis-Chicago)
W71-02143

BASIC CONTEMPORARY URBAN PROBLEMS,
Illinois State Div. of Highways, Springfield.
For primary bibliographic entry see Field 06B.
W71-02144

STORM WATER FOR FUN AND PROFIT,
Chicago Univ., Ill. Center for Urban Studies.
For primary bibliographic entry see Field 06B.
W71-02150

LITTLE FALLS FIBRE CO V HENRY FORD AND SONS (LIABILITY OF LICENSEE FOR MAINTENANCE OF FLASHBOARDS ON FEDERAL DAM).

126 Misc 126, 212 NYS 630-638 (1925).

Descriptors: *New York, *Dams, *Overflow, *Flood damage, Leases, Spillway crests, Spillway gates, Spillways, Federal government, Judicial decisions, Legal aspects, Dam construction, Dam design, Public benefit, Hydraulic structures, Hydroelectric plants, Navigation, Riparian rights, Water rights, Impoundments, Backwater, Relative rights, Competing uses.

Defendant motor company, pursuant to a government lease, constructed a hydraulic powerplant on lands adjoining a federal dam and installed flashboards on the main spillway of the dam. Consequently, the elevation of water on the land of plaintiff manufacturing company was raised, causing damage to its property and water power. Plaintiff brought an action seeking removal by defendant of the flashboards installed on the dam. Defendant contended that it was acting as an agency of the federal government which was authorized to maintain and erect flashboards for the benefit of interstate commerce. Plaintiff contended that defendant erected the flashboards to aid operation of its powerplant. The court, in ordering removal of the flashboards, stated that the federal government, in the interest of navigation, could lawfully maintain flashboards on the dam spillway. However, where maintenance of flashboards by defendant licensee for the purpose of improving its water power plant operation was the cause of damage, maintenance thereof was without justification. (Powell-Florida)
W71-02159

CORBY V RAMSDELL (OBSTRUCTION TO NAVIGATION AS PUBLIC NUISANCE).
48 F2d 701-704 (2d Cir 1931).

Descriptors: *New York, *Admiralty, *Ships, *Navigation, Rocks, Charts, Harbors, Shoals, Warning systems, Navigable waters, Ownership of beds, Damages, Rock foundations, Boats, Shallow water, Channels, Judicial decisions, Legal aspects, Adjudication procedure, Accidents.

Libelant yacht owner brought libel against respondent owner of submerged land for damages to libelant's yacht which resulted from striking submerged rocks on respondent's land. Respondent's predecessor in interest had begun construction of a pier on the tidelands; it was never completed and fell into disrepair, with foundation rocks lying just beneath the surface of the water. Charts indicated the pier and gave water depth from 3 to 8 ft. Libelant's yacht, drawing 4 ft., was run at 26 m.p.h. over the rocks by an unfamiliar master who did not examine the chart. There was a passable channel available. Libelant asserted that the pier was a public nuisance of which respondent had notice. Respondent contended that it was not liable since there was no request to abate the nuisance. The court stated that the rule which requires a request to abate applies only to private nuisance, and noted that no one could maintain a public nuisance with notice without incurring liability. The yacht's passage outside the channel in itself was determined not to relieve respondent from liability. However, the court held that libelant was contributorily negligent, and apportioned the damages awarded. (Hart-Florida)
W71-02160

BURKE V SOUTHERN BELL TEL AND TEL CO (LIABILITY OF UTILITY COMPANY FOR OBSTRUCTION OF RIVER).
55 F2d 732-733 (SD Ala 1932).

Descriptors: *Alabama, *Public utilities, *Boats, *Navigation, Utilities, Bridges, Transportation, Water rights, Judicial decisions, Legal aspects, Rivers, Damages, Remedies, Regulation, Federal government, Floods.

Defendant telephone company stretched wires across a river near a bridge. The wires' location permitted clearance of river steamers' smokestacks even in floodwaters. Subsequently defendant, without federal permission, placed additional wires across the river two feet lower than those originally placed. Plaintiff boat captain knew of the existence and location of the original wires, having passed under those wires during floodwater. In attempting to pass under the bridge during subsequent flood conditions, the boat suffered damages when the additional wires caught plaintiff's boat's smokestacks. Plaintiff brought an action for damages, alleging that defendant was negligent in placing the additional wires. Defendant contended that plaintiff was negligent because of his knowledge of the wires and his failure to ascertain the clearance between the water and the wires. The court held that since all wires were strung without authorization, they constitued an obstruction of the stream for which defendant was liable. The court stated that plaintiff, not knowing that additional wires which were lower than original wires had been placed across the river, was not negligent in attempting to pass under the bridge during floodwaters. (Powell-Florida)
W71-02161

AKTIESELSKABET DAMPSKIB GANSFJORD V UNITED STATES (SHIP MAY BE SUBJECT TO LIBEL IN COURT OF LAW FOR DAMAGE TO LAND OBJECT).
32 F2d 236-237 (5th Cir 1929).

Descriptors: *Louisiana, *Jetties, *Ships, *Admiralty, Rivers and Harbors Act, Legal aspects, Judicial decisions, Remedies, Damages, Legislation, Federal government, Coastal structures, Sea walls, Mississippi River, Navigable waters, Land, Jurisdiction.
Identifiers: *Libel.

Plaintiff federal government brought action in libel against the claimants of the steamship Gansfjord for damage allegedly caused when the ship ran into a jetty in the Mississippi River. Defendant contended that since a court of admiralty would not recognize the suit, because a jetty is considered land and there would be no right of action, the federal district court should not have entertained it. The Court of Appeals, Fifth Circuit, in affirming a judgment for plaintiff, held that the Rivers and Harbors Act of 1899 authorized an action for impairing the usefulness of jetties. The mere fact that a court of admiralty will not recognize the suit because a land object was involved does not mean a court of law cannot handle it. Law courts also recognize remedies against an object, such as the ship, which is used to violate a law. The ship was liable for the damage. (Morris-Florida)
W71-02162

UNITED STATES V NORFOLK-BERKLEY BRIDGE CORP (LIABILITY OF BRIDGE COMPANY FOR OBSTRUCTING NAVIGATION).

29 F2d 115-132 (ED Va 1928).

Descriptors: *Virginia, *Bridge construction, *Rivers and Harbors Act, *Admiralty, Legal aspects, Judicial decisions, Damages, Federal government, Navigable waters, Transportation, Ships, Boats, Bridge design, Disasters, Bridges, Legislation, Navigation, Rivers, Permits, Administrative agencies, Adjudication procedure, Relative rights.

The federal government and a bridge company filed in admiralty to recover from a limitation of liability fund established by a towing company whose tugboats were pulling the government's ships in two separate collisions between the ships and a bridge. The government and the towing company alleged that the bridge company was negligent and that it violated the Rivers and Harbors Act's provisions against obstructing navigation by allowing quadrant gears to overhang a passageway between the bridge's fenders. The federal district court agreed, but also found that the towing company had been negligent because it had warning of the dangerous condition but proceeded to navigate the ships in a manner which led to collisions between the overhanging quadrant gears and the ships' superstructures. The court held that the bridge company could recover from the remainder of the towing company's liability fund despite its negligence since admiralty, in contrast to common law, allows awards based on comparative negligence. The court found that Congress intended such recoveries, even though the bridge company would not have a right of action at common law, in setting up the limitation of liability fund requirements. (Morris-Florida)
W71-02163

THE GANSFJORD (SHIP SUBJECT TO LIBEL FOR DAMAGING JETTY).
25 F2d 736-738 (ED La 1928).

Descriptors: *Louisiana, *Rivers and Harbors Act, *Jetties, *Ships, Disasters, Legal aspects, Judicial decisions, Remedies, Damages, Legislation, Federal government, Navigation, Coastal structures, Sea walls, Admiralty, Mississippi River, Fog, Navigable waters, Channels, Land, Federal jurisdiction, Jurisdiction.

Libellant federal government filed an action in libel against a ship which crashed into a jetty in the Mississippi River. The government claimed the ship violated the Rivers and Harbors Act which prohibited impairment of jetties. Claimant attacked the constitutionality of the Act, which provided a libel remedy in the district court, as an encroachment of admiralty juridiction and also claimed that negligence had not been proven. The district court overruled exceptions and granted a decree for libellant, holding that the Constitution does not bar Congress from distributing admiralty jurisdiction. The court stated that Congress wanted to provide protection for shore properties by admiralty liens since admiralty would not recognize actions involving shore properties and the law remedy was inadequate. The court also held the ship was operated in gross negligence since it was proceeding at full speed in a dense fog in a narrow channel, but added that negligence was not necessary under the language of the Rivers and Harbors Act. (Morris-Florida)
W71-02164

THE GEORGIE (LIABILITY FOR DAMAGE FROM INJURY TO SUBMARINE COMMUNICATIONS CABLE).
14 F2d 98-100 (9th Cir 1926).

Descriptors: *Admiralty, *Anchors, *Electric cables, *Damages, Ships, Communication, Legislation, Judicias, Legal aspects, Navigation, Regulation, Adjudication procedure, Remedies.

Plaintiff United States brought libel against defendant vessel for injury to plaintiff's submarine communications cable. Defendant anchored and snagged the cable, thereby causing the injury. Plaintiff had given no notice of the cable's location, and it was not plotted on marine charts. Plaintiff contended that defendant had imputed knowledge of the cable location and that defendant was negligent per se by anchoring in contravention of area anchoring regulations. The court held that defendant did not have imputed knowledge of the cable location, concluding the plaintiff was required to give notice of its location. Plaintiff's assertion of negligence per se was rejected, the court pointing out that the primary purpose of the anchoring regulations was to ensure safe surface navigation rather than protection for submarine cables. The lower court's decision for plaintiff was reversed. (Hart-Florida)

W71-02165

GULF STATES STEEL CO V LAW (LIABILITY FOR FLOOD DAMAGE BY DAM OWNER).
141 So 641-645 (Ala 1932).

Descriptors: *Alabama, *Obstruction to flow, *Dams, *Natural flow doctrine, Streams, Overflow, Judcial decisions, Legal aspects, Damages, Creeks, Dam construction, Rainfall intensity, Crop response, Natural flow, Backwater, Diversion, Diversion losses, Diversion dams, Easements, Riparian land, Riparian rights, Riparian waters, Relative rights, Reasonable use.

Plaintiff landowner brought action to recover damages for crop destruction by water caused by a dam constructed by defendant corporation across a creek on which plaintiff's property was located. Defendant contended the injury was caused by unusual rainfall and would have resulted even in the absence of its dam. The Supreme Court of Alabama stated that a landowner may maintain a dam across a natural stream for reasonable purposes but cannot impound water in such quantities as to make the stream flood others' lands. The court ruled that plaintiff had the right to have the stream flow in its natural course, that defendant's dam had caused the water of the stream to back up onto plaintiff's property and that plaintiff was entitled to damages for the injury caused thereby. The trial court's judgment for plaintiff was affirmed. (Price-Florida)
W71-02166

PEMBROOKE V PENINSULAR TERMINAL CO (POWER OF STATE TO DISPOSE OF SUBMERGED LAND).
146 So 249-264 (Fla 1933).

Descriptors: *Florida, *Navigable waters, *Ownership of beds, *Land tenure, Beds, Tidal waters, Water levels, Federal government, Federal jurisdiction, State jurisdiction, State governments, Navigation, Channels, Islands, Bays, Overflow, Riparian rights, Administrative agencies, High water mark, Low water mark, Shores, Dredging, Tides, Judicial decisions, Legal aspects, Public rights.

Complainant corporation sought to obtain the balance of money owed to it by defendant for land purchased. The land was located on an island which had originally been submerged bottom land. Defendant denied that complainant could convey good title and sought rescission and return of money already paid. The trial court struck defendant's allegations for affirmative relief and the Supreme Court of Florida affirmed. Defendant's contention that the statutes under which the land was originally sold were void was without merit. Such statutes were not unconstitutional, did not interfere with the public's interest in navigation, fishing and other purposes and were not in conflict with the paramount jurisdiction of the federal government over navigable waters. Defendant's contention that the original deed from the state trustees was void because the submerged land was under too great a depth of water was also rejected. Such a contention amounted to a collateral attack upon the grant by the trustees, and such an attack is not permissible in a suit between private parties. Finally, defendant's contention that the federal government's power to remove obstructions from navigable waters consituted an encumbrance to the title was without merit. Such power was not an encumbrance which warranted rescission of the contract. (Duss-Florida)
W71-02167

STATE EX REL LANDIS V ROSENTHAL (EXCLUSIVE FRANCHISE FOR BRIDGE OPERATION).
148 So 769-776 (Fla 1933).

Descriptors: *Florida, *Permits, *Bridges, *Bridge construction, Legislation, State governments, Local governments, Navigable waters, Beds under water, Highways, Federal government, Administrative agencies, Administrative decisions, Remedies, Judicial decisions, Legal aspects, Public rights.

Defendant had been granted an exclusive franchise to build and operate a toll bridge over navigable state waters. The franchise was conditioned on approval by the state road department and the United States War Department. In an action of quo warranto, the state sought the ouster of defendant from the project on the grounds that such an exclusive franchise was beyond the authority of the statute allowing private licenses for such projects to be granted. The Supreme Court of Florida, holding that navigable waters and lands underlying them are held by the state in trust for its citizens, granted the petition for ouster. The court also ruled that when the state delegated its power to the county, certain limitations on the power were inherent in the grant. Disallowance of the ability to create an exclusive franchise was such a limitation. (Barker-Florida)
W71-02168

CITY OF SHREVEPORT V WILKINSON (CONSTITUTIONALITY OF ORDINANCE DENYING ACCESS TO LANDOWNER'S HOME).
182 La 783, 162 So 621-622 (1935).

Descriptors: *Louisiana, *Water supply, *Supervisory control (Power), *Cities, Local governments, Governments, State governments, Federal government, Legal aspects, Judcial decisions, Lakes, Land, Real property, Water pollution, Legislation, Water pollution control, Adjudication procedure, Navigable waters, Regulation.

Defendant was arrested pursuant to a city ordinance prohibiting passage of boats on a lake at night. The state had conveyed the bed of the lake to plaintiff city and delegated to the city the right to enforce regulations to protect the lake's water from contamination as a water supply. Defendant had erected a recreation home on an island in the lake and was arrested while conveying guests to the shore. Defendant contended that the city ordinance was unconstitutional as an unreasonable exercise of the police powers of the state. The Supreme Court of Louisiana affirmed a judgment for defendant. The ordinance was valid on its face as a reasonable exercise of the delegated power to protect the water supply. However, its rigid enforcement against a landowner, denying him access to his home, was unreasonable. Boats were not prohibited from traversing the lake in the daylight hours and little could be gained by prohibiting passage by defendant at night. (Dye-Florida)
W71-02169

ILHENNY V BROUSSARD (DIVERSION OF WATERS FROM NAVIGABLE STREAMS).
172 La 895, 135 So 669-670 (1931).

Descriptors: *Louisiana, *Diversion, *Navigable waters, *Alteration of flow, Obstruction to flow, Remedies, Legal aspects, Adjudication procedure, Judicial decisions, Navigation, Navigable waters, Streams, Canals, Structures, Flow, Natural streams, Running waters, Public rights, Watercourses (Legal).

Plaintiff sought to enjoin defendant from using his private navigable canal. Defendant contended that plaintiff had diverted so much water into his canal from a previously navigable watercourse that the watercourse was no longer navigable. Defendant contended that plaintiff's diversion authorized the public to make free use of the waters in their new artificial channel. Plaintiff contended that the navigability of the natural stream was in no way diminished. The Supreme Court of Louisiana affirmed a judgment for plaintiff. Plaintiff's canal was private, and defendant was not authorized to trespass on it. If the natural watercourse had in fact been rendered non-navigable, plaintiff might have been enjoined from further diversion. Defendant's proper remedy was appealed to the Secretary of War, whose powers included regulation of navigable streams, or a suit to enjoin plaintiff from diverting so much water as to impede the navigability of the natural watercourse. (Dye-Florida)
W71-02170

FLORIDA EAST COAST RY V ACHESON (LIABILITY FOR OBSTRUCTION TO NAVIGATION).
135 So 551-553 (Fla 1931).

Descriptors: *Florida, *Accidents, *Ships, *Navigable waters, Adjudication procedure, Legal aspects, Hazards, Judicial decisions, Admiralty, Oceans, Piles (Foundations), Structures, Railroads, Damages.

Plaintiff ran his boat into a piling in a navigable channel. Plaintiff sought damages, introducing evidence that defendant railroad had placed pilings in the channel 16 years prior to the accident. The Supreme Court of Florida reversed a judgment for plaintiff. The court stated that some negligence on the part of defendant had to be shown which directly contributed to the injury complained of. The court held that evidence that defendant once placed pilings in the channel was not sufficient to sustain a verdict for plaintiff without a showing that it was one of defendant's pilings which was encountered. (Dye-Florida)
W71-02171

VOLENTINE V HOUSEMAN (LIABILITY FOR OBSTRUCTING DRAINAGE DITCH).
130 So 863-864 (La 1930).

Descriptors: *Louisiana, *Ditches, *Surface drainage, *Obstruction to flow, Legal aspects, Judicial decisions, Damages, Drainage, Surface waters, Surface runoff, Channels, Channel flow, Flow, Crops, Erosion, Overflow, Culverts, Riddance (Legal aspects), Highways.

Plaintiff landowner sued for damage to his land and crops allegedly caused when defendant landowner obstructed a ditch, thereby causing surface water to overflow plaintiff's land. Defendant denied that the overflow was his fault. Plaintiff's land was lower than defendant's, and the two tracts were separated by a street. A natural drain had been converted into a ditch which carried surface water through defendant's land and through a culvert under the street. A continuation of the ditch carried the water from plaintiff's land. The Court of Appeal of Louisiana, in affirming a judgment for plaintiff, found that defendant, in clearing his land of lumber and brush, had placed the debris in his ditch and it clogged the culvert, causing water to flow over the street rather than through the ditch and to flood plaintiff's land. Defendant thus was liable for obstructing the natural flow since an upper proprietor may not increase the burden of the servitude of a lower estate. (Morris-Florida)
W71-02172

SCRANTON-PASCAGOULA REALTY CO V CITY OF PASCAGOULA (ARTIFICIAL CHANNEL MAY BECOME WATERCOURSE BY PRESCRIPTION).
128 So 73-76 (Miss 1930).

Descriptors: *Mississippi, *Watercourses (Legal), *Artificial watercourses, *Culverts, Channel improvement, Legal aspects, Judicial decisions, Remedies, Bayous, Cities, Local governments, Legislation, Channels, Channel flow, Concrete structures, Drainage systems, Drainage, Prescriptive rights.

Plaintiff landowner sought an injunction against defendant city to prevent construction of an enlarged culvert beneath a city street. Plaintiff, whose land would be damaged by discharge from the concrete culvert, claimed it violated a statute which allowed the city to change the channels of watercourses only after voter approval. Defendant contended

that the culvert was not a watercourse and that it was not changing the channel. The Supreme Court of Mississippi, in reversing a lower court disallowance of the injunction, found that the old culvert was constructed by a ship building company as a drainage substitute when it filled in part of the adjoining bayou. It was thus originally an artificial channel, but by prescription had become a watercourse. The new culvert would be larger and carry a greater volume of water, thus amounting to a change of the channel. This the city could not do under the statute. (Morris-Florida)
W71-02173

MARTIN V LOUISIANA PUB UTIL CO (RIGHTS OF PARTIES UNDER WATER CONTRACT).
127 So 470-472 (La 1930).

Descriptors: *Louisiana, *Contracts, *Water contracts, *Prescriptive rights, Sewers, Contract administration, Judicial decisions, Legal aspects, Drainage, Drains, Sewage, Aqueducts, Conduits, Waste water disposal, Utilities.

Plaintiff brought action for the restoration of services from defendant utilities company on the theory that he had acquired by prescription the servitude of draining the refuse water from his private residence through a sewer owned by defendant. Plaintiff contended that in years past he had contracted with defendant's predecessor for the use of the sewer for drainage on the condition that he would buy his water from defendant's predecessor, that he had complied with the contract and that therefore he had obtained a servitude on the sewer now owned by defendant. Defendant denied such an agreement and any resulting prescriptive right. The court ruled that plaintiff had simply had a contract with the predecessor of defendant, that defendant had assumed no obligation thereunder and that plaintiff could not have obtained a prescriptive right as claimed under the contract. The judgment for defendant was affirmed. (Price-Florida)
W71-02174

BAKER V VOSS (TITLE TO BEDS OF NAVIGABLE WATERS).
259 NW 413-415 (Wis 1935).

Descriptors: *Wisconsin, *Ownership of beds, *Navigable waters, *Access routes, Public rights, Lakes, Streams, Boundaries (Property), Beds, Beds under water, State governments, Riparian rights, Relative rights, Remedies, Judicial decisions, Legal aspects.

Plaintiffs sought to enjoin defendant from interfering with plaintiffs' access to an allegedly navigable lake which lay within the boundaries of defendant's land. The lake was joined to another, smaller lake by a shallow, narrow stream, and only a small portion of the second lake was outside of defendant's property. The neighboring landowners allowed the public to enter upon the smaller lake, but defendant erected a fence across the stream, thus preventing entry to the larger lake. The trial court found all the waters in question to be navigable and granted the injunction. Affirming, the Supreme Court of Wisconsin ruled that the state has title to the beds of all navigable waters, whether meandered or not. An injunction will lie against interference with the public rights in such navigable waters. (Barker-Florida)
W71-02175

ERICKSON V COUNTY OF STEARNS (LIABILITY OF COUNTY FOR DAMAGES FROM DAM OPERATION).
252 NW 219-221 (Minn 1934).

Descriptors: *Minnesota, *Dam construction, *Water levels, *Flood damage, Damsites, Dams, Operation and maintenance, Height, Lakes, Local governments, Legislation, Administrative agencies, Elevation, Jurisdiction, State jurisdiction, Land, Riparian land, Floods, Flooding, Remedies, Judicial decisions, Legal aspects.

Plaintiff riparian landowner brought an action for damages caused by defendant county's alleged improper maintenance of a dam on a certain lake. The major portion of the lake lay within another county, but a small part was within defendant's boundaries. Under Minnesota law, the state delegated its power over control of water levels in navigable waters to the several counties, and petition was made to defendant county to establish a dam to control the level in the portion of the lake within its boundaries. The dam was constructed by the state game and fish department, with defendant agreeing to pay half the costs. Plaintiff's property was flooded as a result of the dam, and the dam was removed when defendant required the game and fish department to do so. Defendant denied liability for plaintiff's damage under the doctrine of ultra vires. The trial court accepted the defense that defendant could not be liable since it had no authority over the dam's maintenance, and the case was dismissed. Affirming, the Supreme Court of Minnesota ruled that the legislature could not have attempted to give a county control over a lake, the major portion of which lay in another county. Therefore, defendant had no interest in the lake, and any attempt to exercise an interest was ultra vires. (Barker-Florida)
W71-02176

HAASE V KINGSTON CO-OPERATIVE CREAMERY ASS'N (OWNERSHIP OF LAND UNDER ARTIFICIAL LAKE).
250 NW 444-445 (Wis 1933).

Descriptors: *Wisconsin, *Ownership of beds, *Relative rights, *Land tenure, Beds, Beds under water, Dams, Damsites, Ponds, Ponding, Public rights, Recreation, Ice, Lake ice, Riparian rights, Artificial watercourses, Water utilization, Remedies, Judicial decisions, Legal aspects.

Plaintiff landowner sought to recover the value of ice taken by defendant from a pond on plaintiff's property. Plaintiff's predecessor had constructed a dam whereby the pond was created. The public had been allowed full access to the pond. Defendant argued that such public access had vested title to the lake and the land beneath it in the state by adverse possession, thus giving the public the right to harvest the ice. The Supreme Court of Wisconsin, in affirming the trial court's decision for plaintiff, ruled that a landowner may permit the public to enjoy an artificial body of water, and such allowance may ripen into a dedication which the owner may not abolish. However, such dedication does not constitute adverse possession in the state. Ownership in the lake and underlying property was held to remain in plaintiff, and recovery for the value of the ice was allowed. (Barker-Florida)
W71-02177

FLAMBEAU RIVER LUMBER CO V GETTLE (RIGHT OF LUMBER COMPANY TO HAVE RIVER NAVIGABLE FOR DRIVING LOGS).
236 NW 671-679 (Wis 1931).

Descriptors: *Wisconsin, *Lumbering, *Impounded waters, *Reservoirs, Alteration of flow, Discharge (Water), Legal aspects, Judicial decisions, Dams, Saw mills, Equalizing reservoirs, Navigation, Navigable rivers, Reservoir operation, Water levels, Administrative agencies, Riparian rights, Water rights.

The Railroad Commission, of which defendant was a member, issued an order authorizing the retention of all the flow of a river, except 150 cubic feet per second, during the time when logs were being driven upon said river. Plaintiff lumber company was forced to abandon its log drives. Plaintiff brought an action to have the Commission's order vacated, alleging that plaintiff was deprived of its right of navigation upon the river. Plaintiff also alleged that 1300 cubic feet of water per second was needed to conduct log drives. Defendant alleged that the Commission was empowered to control drawing of water from river reservoirs in order to maintain uniform flow. The Supreme Court of Wisconsin affirmed the lower court's decision vacating the Railroad Commission's order. The court held that plaintiff was entitled to water at times and in quantities necessary to make the river navigable for driving logs. The court also held that it was unauthorized to determine the quantity of water reasonably necessary in the river for log driving, such determination being an administrative matter. (Powell-Florida)
W71-02178

DELTA FISH AND FUR FARMS V PIERCE (STATUS OF WATERS PREVIOUSLY ADJUDGED NON-NAVIGABLE).
234 NW 881-886 (Wis 1931).

Descriptors: *Wisconsin, *Navigable waters, *Public rights, *Non-navigable waters, Adjudication procedure, Judicial decisions, Legal aspects, Relative rights, Land, Real property, Recreation, Hunting, Fishing, Diversion, Drainage districts, Streams, Rivers, Navigation.

Plaintiff muskrat framing company sought to restrain defendants from trespassing on its inundated land for the purpose of hunting and fishing. Defendants contended the water on plaintiff's land was navigable and therefore subject to public recreation. Plaintiff's property had formerly been covered by the waters of a navigable stream which had been diverted under an action brought by a local drainage district. The court in that action found that no navigable water would remain on plaintiff's property after the diversion. In reversing a judgment for defendants, the Supreme Court of Wisconsin held that the question of the navigability of the waters on plaintiff's property was res judicata. The proceeding brought by the drainage district was in rem and conclusive of all questions therein adjudicated. Some petitioners in the proceeding had argued the exact issue presented by defendants. Since the waters were adjudged non-navigable, no rights thereafter existed in the public to trespass on plaintiff's land. (Dye-Florida)
W71-02179

PFANNEBECKER V CHICAGO RI AND P RY (LIABILITY FOR DAMAGES RESULTING FROM TWO OR MORE CAUSES).
226 NW 161-164 (Iowa 1929).

Descriptors: *Iowa, *Obstruction to flow, *Adjudication procedure, *Damages, Remedies, Legal aspects, Judicial decisions, Flow, Floods, Flooding, Precipitation excess, Streams, Railroads, Alteration of flow, Bridges, Crops, Overflow, Banks, Flood damage, Rain water, Structures.

Plaintiff's property lay in a valley through which passed a stream. Defendant railroad constructed an embankment and bridge across the valley downstream from plaintiff. During a period of heavy rains, plaintiff's fields were flooded and his crops destroyed. Plaintiff brought action against defendant for damages, contending that the floodwaters were turned from their natural course by defendant's embankment and backed onto his property. The Supreme Court of Iowa reversed a judgment for plaintiff. Plaintiff's own evidence suggested that part of his damage resulted from normal overflow of the stream. Plaintiff was unable to segregate with any certainty the damage caused by defendant's embankment and that which would have otherwise occurred. Despite instructions by the trial judge that if any damage resulted from causes other than defendant's embankment plaintiff was not entitled to a verdict, the jury returned a verdict for plaintiff. The court held that the jury was in error. The extent of defendant's liability as established by plaintiff was too speculative to warrant a judgment. (Dye-Florida)
W71-02180

PIKE RAPIDS POWER CO V SCHWINTEK (SPECIFIC PERFORMANCE OF CONTRACT TO CONVEY FLOWAGE RIGHTS).
223 NW 612-614 (Minn 1929).

Descriptors: *Minnesota, *Dams, *Backwater, *Contracts, Design flood, Maximum probable flood, Land tenure, Real property, Flooding, Flood damage, Hydroelectric plants, Lumber, Judicial decisions, Legal aspects.

Plaintiff power company sought specific performance of a contract against defendant riparian landowner for the conveyance of certain flowage rights. Defendant's predecessor sold flowage rights to plaintiff over part of his land and agreed to convey flowage rights for any remaining land which might be overflowed for $50 an acre. The dam caused flowage over 35 more acres than originally conveyed, but defendant refused to convey the flowage rights for this additional land upon plaintiff's tender of the agreed price. Defendant contended that: (1) there was no meeting of the minds; (2) there was no consideration for the conveyance; (3) he adversely possessed the lands; and (4) specific performance would be inequitable. The court found that defendant had failed to sustain the burden of showing an inadequate meeting of minds. Defendant's contention of no consideration was rejected since the payment of $50 an acre for the additional land was obviously adequate consideration. Defendant's additional contentions were rejected as frivolous, and the lower court's decision for plaintiff was affirmed. (Hart-Florida)
W71-02181

BEAVERTON POWER CO V WOLVERINE POWER CO (BREACH OF ORAL CONTRACT TO CONVEY FLOWAGE RIGHTS).
222 NW 703-705 (Mich 1929).

Descriptors: *Michigan, *Dams, *Backwater, *Contracts, Design flood, Maximum probable flood, Land tenure, Real property, Flooding, Flood damage, Claims (Contracts), Hydroelectric plants, Damages, Compensation, Judicial decisions, Legal aspects, Adjudication procedure, Relative rights, Competing uses.

Plaintiff power company sought specific performance of an alleged contract with defendant power company to release flowage rights to certain riparian farmland. Defendant assured plaintiff that its dam would not back water to the point of the Weinboldt and Hunter farms, which were located across a river from one another. Defendant owned both farms. Relying upon defendant's assurance, plaintiff purchased the Hunter farm outright, and purchased the Weinboldt farm subject to defendant's flowage rights thereon. Plaintiff contended that defendant had agreed to release the Weinboldt flowage rights for $600. Defendant alleged that plaintiff had agreed to sell flowage rights on the Hunter farm if defendant's dam backed water over it. Both the alleged agreements were oral. The court determined that flowage rights were interests in land and could only be purchased by a written instrument under seal. Accordingly, the court refused to enforce the rights asserted by either party. However, the court awarded plaintiff more than the value of the land overflowed by defendant's dam since it was purchased with defendant's assurance that such land would not be overflowed. (Hart-Florida)
W71-02182

ANDERSON V OTTER TAIL POWER CO (LIABILITY FOR BREACH OF COVENANT TO PROVIDE POWER FROM DAM).
220 NW 404-406 (Minn 1928).

Descriptors: *Minnesota, *Dams, *Contracts, *Flooding, Judicial decisions, Legal aspects, Land tenure, Real property, Water supply, Water contracts, Dam construction, Damsites, Adjudication procedure.

Plaintiff landowner sued defendant power company for damages for breach of covenant. Plaintiff owned property containing a dam. Plaintiff sold the property to defendant's predecessor, who agreed to provide 20 horsepower to plaintiff from that dam or any future dam which might be built. Plaintiff continued to operate the dam, but permitted it to fall into disrepair. Defendant subsequently purchased the tract and built another dam downstream, flooding the old dam. Plaintiff contended that defendant was required by the covenant to erect a new dam on the original damsite. Plaintiff further alleged that flooding of the damsite created a right of damages and that defendant was required to provide the specified power from the lower dam. Defendant contended that the covenant did not run with the land and that it did not require erection of a new dam. The court refused to decide whether the covenant ran with the land since it held that the terms of the covenant clearly provided no obligation to build a new dam. The court also determined that the covenant did not create a right of damages or right to water power. The lower court's decision for plaintiff was reversed. (Hart-Florida)
W71-02183

CITY OF BARABOO V RAILROAD COMM'N (JUDICIAL REVIEW OF ADMINISTRATIVE ORDER TO LOWER DAM HEIGHT).
218 NW 819-820 (Wis 1928).

Descriptors: *Wisconsin, *Dams, *Administrative agencies, *Legislation, Water levels, Power head, Height, Tailwater, Water level fluctuations, State governments, Cities, Judicial decisions, Legal aspects, Adjudication procedure, Administrative decisions, Regulation, Supervisory control (Power), Navigable waters.

Plaintiff city brought action to set aside an order of defendant commission requiring plaintiff to lower its dam two inches. The dam was authorized by legislation. Among other things, plaintiff contended that it had a right to maintain a 14 ft. dam, whereas the dam which defendant had ordered lowered was only 12 1/2 ft. high. To establish this contention, plaintiff had offered evidence that the dam was higher at a time before the authorizing legislation for the present dam was enacted, but the trial court refused to consider this evidence. The Supreme Court of Wisconsin pointed out that even if the higher level were established, plaintiff could only maintain the waterhead the legislature authorized. A state may refuse permission to a riparian owner to build a dam in a navigable stream or it may attach conditions to its consent. The court held that defendant's order was proper and affirmed the lower court's decision for defendant. (Hart-Florida)
W71-02184

ANGELO V RAILROAD COMM'N (CONSTITUTIONALITY OF CONTRACT TO REMOVE MARL FROM LAKEBED).
217 NW 570-577 (Wis 1928).

Descriptors: *Wisconsin, *Contracts, *Riparian rights, *Ownership of beds, Beds under water, Legislation, Navigable waters, Lakes, Administrative agencies, Administrative decisions, State governments, Eminent domain, Permits, Lake beds, Lake soils, Navigation, Marl, Calcareous soils, Calcium compounds, Caliche, Grants, Judicial decisions, Legal aspects.

Plaintiff littoral landowners brought action to have the acts of defendant Railroad Commission which granted a right to remove marl from a navigable lake declared unconstitutional. Defendant was authorized by legislation to contract for removal of material from navigable lake beds and to determine compensation to be paid the state therefor. Plaintiffs contended that any removal contract would unconstitutionally violate their riparian rights. The court noted that: (1) the state constitution declared a public trust in navigable waters for navigation, but not to the land thereunder; (2) a riparian owner on a navigable lake does not hold title to the lakebed, because title to such beds is in the state; (3) in absence of a legislative declaration, whether a lake is navigable is a fact question; and (4) the state may only destroy riparian rights through exercise of the eminent domain power. Since the littoral landowners did not have title in the lakebed, the court concluded that the statute was not an improper exercise of the police power and held that defendant could properly execute a contract for removal of marl without violating plaintiffs' riparian rights. However, the lower court's decision for defendant was reversed on other grounds. (Hart-Florida)
W71-02185

MILLER V PERKINS (OBSTRUCTION OF SURFACE RUNOFF).
216 NW 27-29 (Iowa 1927).

Descriptors: *Iowa, *Diversion, *Obstruction to flow, *Surface runoff, Natural flow, Natural flow doctrine, Culverts, Ditches, Judicial decisions, Legal aspects, Diversion structures, Diversion dams, Drainage, Overflow, Right-of-way, Railroads, Tile drains, Backwater, Crop response, Surface drainage.

Plaintiff sought to enjoin defendant from obstructing the natural flow of surface runoff from plaintiff's dominant estate. Defendant had constructed a ditch between the two pieces of property to prevent the overflow from coming onto his property. The parties stipulated that the ditch should have been maintained so as not to cause water to be backed up onto plaintiff's property. There was disagreement as to just how said ditch was to be maintained. Defendant's tenant had constructed a dam that also caused water to back up to plaintiff's injury, but did so only when defendant's ditch was improperly maintained. The court ruled that defendant could prevent the surface water from flowing over his property if in doing so he did not prejudice plaintiff. The case was remanded to have determined the issue of the sufficiency of defendant owner's ditch and to consider the need for enjoining the maintenance of defendant's tenant's dam. (Price-Florida)
W71-02186

CITY OF MILWAUKEE V STATE (SALE OF SUBMERGED LANDS TO AID NAVIGATION).
214 NW 820-832 (Wis 1927).

Descriptors: *Wisconsin, *Navigation, *Ownership of beds, *Public rights, Legislation, Judicial decisions, Legal aspects, Navigable waters, Lake Michigan, Shores, Condemnation, Contracts, Lakes, Cities, Relative rights, Harbors, Land tenure, Mississippi River, Great Lakes, Land reclamation, Local governments, State governments, Public health.

Plaintiff city brought action to quiet title to certain submerged lands at the edge of Lake Michigan. Plaintiff claimed the land through a grant from the state legislature. Defendant state contended that the land had to be held in trust for the public and be utilized only in aid of navigation. Plaintiff had agreed to convey title to the land to a private corporation in exchange for a piece of property owned by said corporation which plaintiff considered vital to the successful construction of port facilities. After considerable deliveration, the court found that the granting of the land to the corporation and the subsequent construction of a pier thereon would not be a violation of the trust doctrine but rather a necessary step to be taken in the aid of navigation and commerce. The judgment of the lower court in favor of plaintiff was affirmed. (Price-Florida)
W71-02187

MELANDER V FREEBORN COUNTY (DAMAGES TO LAND AND CROPS AS A RESULT OF DAM CONSTRUCTION).
212 NW 590-591 (Minn 1927).

Descriptors: *Minnesota, *Lakes, *Dams, *Water levels, Navigable waters, Meanders, Judicial decisions, Legal aspects, Watersheds (Basins), Public rights, Flooding, Administration, Dam construction, Erosion, Crops, Obstruction to flow, Outlets, High water mark, Discharge (Water), Floodwater, Local governments.

Plaintiffs were riparian landowners upon a navigable lake. Their land was usually tillable, but portions of it was marshy and flooded when the level of the lake was high. Defendant county built a dam across the outlet of the lake to maintain the water at its 'usual' level. Plaintiffs brought an action for damages, claiming that the dam held the water higher than state law authorized. The trial court found that the dam was in no way an obstruction to flow and that plaintiffs' lands and crops were never flooded as a result of the dam construction. The height of the water was found to be controlled by the subcrests of the dam and not by that balance of the dam extending above the height of the subcrest. The Supreme Court of Minnesota affirmed the lower court's decision for defendant, finding that the dam held the water at a level no higher than that which nature had prior to the dam's construction. Defendant had complied substantially with state statutes in building the dam to maintain the water at its natural level. (Barnett-Florida)
W71-02188

THE COLOMBO (FEDERAL STATUTE PROHIBITING POLLUTION OF NEW YORK CITY HARBOR).
28 F2d 1004-1005 (SD NY 1928).

Descriptors: *New York, *Admiralty, *Water pollution, *Navigable waters, Legislation, Harbors, Ships, Oil, Oil wastes, Sludge, Judicial decisions, Legal aspects, Oily water, Adjudication procedure, Accidents, Federal government, United States, Water pollution control, Water pollution sources.

The United States brought libel action against a steamship for dumping oil into New York harbor in violation of a federal act prohibiting the discharge of injurious deposits into the harbor or adjacent waters. The court dismissed the action, holding that the statute must be strictly construed and cannot be said to be violated when a barge pumped valuable oil into the sea through a valve on the ship which unknowingly had been left open. (Duss-Florida)
W71-02189

MATTER OF FORD (COMPENSATION FOR DEPRESSED LAND VALUES WHERE REDUCED WATER SUPPLY UPSET RIVER'S ECOLOGY).
313 NYS2d 42-52 (App Div 1970).

Descriptors: *New York, *Eminent domain, *Water supply, *Compensation, Land tenure, Easements, Real property, Land appraisal, Land use, Right-of-way, Dams, Cities, Administrative agencies, Fishing, Swimming, Boating, Ecology, Balance of nature, Rivers, Judicial decisions, Legal aspects, Damages, Water resources, Water shortage, River flow.

The Board of Water Supply of the City of New York appealed from a decision affirming the report of commissioners of appraisal in eminent domain proceedings. Appellant had condemned water from a river to supply its inhabitants. The subsequent impairment of the river flow upset the ecology of the river, destroying its usefulness for swimming, boating and fishing. Accordingly, the market values of properties downstream from appellant's dam were depressed. In one instance respondent claimed indirect damage to a non-riparian tract, contending that it was the dominant tenement in an appurtenant right-of-way to the river. Determining that the right-of-way did not apply to that tract, the court disallowed compensation. The court also found that two other tracts for which respondent had claimed compensation were conveyed prior to appellant's condemnation and disallowed compensation for these tracts. The commissioners' orders were affirmed in part and reversed in part. (Hart-Florida)
W71-02190

THOMPSON V WATER RESOURCES COMM'N (JUDICIAL REVIEW OF DREDGING PERMIT).
267 A2d 434-438 (Conn 1970).

Descriptors: *Connecticut, *Dredging, *Landfills, *Permits, Administrative agencies, Administrative decisions, State governments, Decision making, Channels, Streams, Backfill, Land development, Marshes, Ecology, Balance of nature, Legislation, Legal aspects, Judicial decisions.

Plaintiff landowner brought action to repeal defendant commission's grant of a dredge permit to an adjoining landowner. The adjoining landowner wished to dredge and fill his riparian property in order to subdivide it for high-grade residences. He intended to use the dredged material to fill in an artificial channel and a concave area along his shore. He applied to defendant for a dredge permit as required by statute. The statute required defendant, in rendering the decision, to consider the area's ecology, the rights of other owners, and navigation. The permit was opposed by 60% of the neighboring landowners, who contended that the area's basic ecology would be upset by the dredging. Defendant conducted a public hearing and concluded that the proposed dredging would injure the ecology only slightly and that certain aspects of the ecology would be improved. Plaintiff contended that defendant's only legal decision was to deny the permit. The court found that defendant had properly examined all required considerations and that the evidence amply supported defendant's decision. The lower court's decision for defendant was affirmed. (Hart-Florida)
W71-02191

JACKVONY V POWEL (PUBLIC PASSAGE BETWEEN HIGH AND LOW WATER MARKS).
21 A2d 554-558 (RI 1941).

Descriptors: *Rhode Island, *Public rights, *Beaches, *Access routes, Boundaries (Property), Local governments, Administrative decisions, Community development, Judicial decisions, Land tenure, Legal aspects, Legislation, Proprietary power, Recreation, Relative rights, Riparian land, State governments, High water mark, Low water mark, Barriers.
Identifiers: *Constitutionality, Fences.

By special act the Rhode Island legislature clothed defendant City Commission of Newport with authority to take charge of and control the beachfront within the city limits, including the shores thereof between the high and low water marks. Pursuant to this act, the city proposed to fence in the beach within the city limits down to the low water mark. Plaintiff attorney general sued to enjoin such construction on the grounds that the special act was unconstitutional. The state constitution provided that the people would continue to enjoy all the rights and privileges of the shore. The court held that such rights and privileges included the right to public passage along the shore, subject, possibly, to reasonable regulation. The act was found to be unconstitutional in that the powers it vested in the commission were too broad and unrestricted to assure that public passage would not be materially impaired. (Clarke-Florida)
W71-02192

HOLYOKE WATER POWER CO V WHITING AND CO (UNAUTHORIZED USE OF WATER SUPPLY).

276 Mass 528, 177 NE 568-574 (1931).

Descriptors: *Massachusetts, *Water utilization, *Water contracts, *Water supply, Dams, Mill dams, Industrial plants, Canals, Water rates, Water rights, Relative rights, Artificial use, Grants, Industrial production, Dam design, Networks, Network design, Remedies, Adjudication procedure, Judicial decisions, Legal aspects, Contracts.

Plaintiff water power company sought to enjoin defendant from using water supplied by plaintiff in a manner different than the stated restrictions in certain grants of water rights from plaintiff to defendant. Plaintiff alleged that defendant used water on lands to which the supply was not appurtenant, used amounts of water in excess of the grants, was planning to use the supply for purposes prohibited in the grants and operated its water gates during hours not contemplated in the grants. Defendant argued that the alleged improper uses were not expressly prohibited by the grants. Ruling that grants such as those in question must be interpreted in light of all the normal material circumstances and not in light of the words alone, the Supreme Judicial Court of Massachusetts granted the injunction sought by plaintiff. The court stated that use of water for unauthorized purposes is a sufficient ground for equitable relief. (Barker-Florida)
W71-02193

BELKUS V CITY OF BROCKTON (LIABILITY FOR FLOOD DAMAGE FROM BLOCKED STREAM).
184 NE 812-15 (Mass 1933).

Descriptors: *Massachusetts, *Flood damage, *Drainage practices, *Remedies, Cities, Local governments, Legislation, Streams, Drainage, Drainage systems, Floods, Flooding, Damages, Water levels, Pipes, Obstruction to flow, Adjudication procedure, Judicial decisions, Legal aspects.

In an action to recover for flood damages, plaintiff contended that defendant city negligently operated its drainage system. After the city had improved a series of watercourses in order to facilitate better drainage, pipes were laid in streams where required. Plaintiff claimed that the water levels of such streams were raised and that resulting backwater flooded the basement of his building. Defendant claimed that it was acting pursuant to legislation, and any damages should be recoverable on the theory of a taking, not under tort action. Finding that the damages were caused by the negligence of defendant, the Supreme Judicial Court of Massachusetts ruled that tort was the proper action in such a case. The court further ruled that the measure of damages in a temporary nuisance was the combination of the amount spent by plaintiff to remedy the damage and the diminution of rental value while the injury continued. (Barker-Florida)
W71-02194

CAPE ROMAIN LAND AND IMPROVEMENT CO V GEORGIA-CAROLINA CANNING CO (OWNERSHIP OF LAND BETWEEN HIGH AND LOW WATER MARKS).
146 SE 434-440 (SC 1928).

Descriptors: *South Carolina, *Ownership of beds, *Low water mark, *High water mark, Legal aspects, Judicial decisions, Remedies, Damages, Tidal waters, Tides, Navigable waters, Bays, Navigable rivers, Boundaries (Property), Coastal marshes, Wetlands, Public rights, State governments, Tides, Prescriptive rights.

Plaintiff land company sought to restrain defendant oyster companies from trespassing on lands plaintiff claimed to own and also sought damages for prior trespasses. Defendants, who had leased the lands from the state, contended that the lands were between the high and low water marks of navigable waters and thus were owned by the state in trust for the people. The Supreme Court of South Carolina affirmed a lower court's decision for defendants. The court stated that title to land on tidal waters runs to the high water mark, the limit of the flux of

the usual tide, unless otherwise shown. The court held that plaintiff failed to produce sufficient evidence to show either a grant or adverse possession to the low water mark. The fact that plaintiff's deed specified marshland was insufficient since marshland can be dry in some seasons. A dissenting opinion noted that of 34,290 acres of marshland plaintiff's predecessors purchased from the state, only 6.2 acres were above the high water mark. Thus, although the deeds did not specify that title was to extend to the low water mark, that construction would be more reasonable. (Morris-Florida)
W71-02195

LANGERIN V FLETCHER (INTERPRETATION OF 'BANK' AS PROPERTY BOUNDARY).
273 Mass 543, 174 NE 194-196 (1931).

Descriptors: *Massachusetts, *Boundaries (Property), *Banks, *Ravines, Legal aspects, Judicial decisions, Remedies, Ownership of beds, Watercourses (Legal), Streams, Channels, Streambeds, Riparian land, Boundary disputes, Adjudication procedure.

Petitioner sought to register title to a ravine through which a small brook formerly flowed. Petitioner previously had owned land on both sides of the brook, but later granted title to land on the south side to the predecessors in title of respondent. The deed to such land specified the grant was 'to the southerly bank of a brook.' Respondents contended this meant to the actual high water mark of the water, but petitioners claimed it meant only to the top of a high bank at the edge of the ravine. The Supreme Judicial Court of Massachusetts affirmed a lower court opinion that the deed was abmiguous, and thus evidence was properly admitted which showed that petitioner intended to grant only to the edge of the top of the ravine. Where a word in a deed is ambiguous, the meaning must be obtained from the instrument as a whole and the surrounding circumstances. A grant of land bounded by a bank of a stream generally excludes the bed if such bank has any width apart from the bed. (Morris-Florida)
W71-02196

WHITE V KNICKERBOCKER ICE CO (OWNERSHIP OF BEDS AS AFFECTED BY PROPERTY DESCRIPTION).
254 NY 152, 172 NE 452-455 (1930).

Descriptors: *New York, *Easements, *Boundaries (Property), *Ownership of beds, Banks, Legal aspects, Judicial decisions, Remedies, Lakes, Riparian land, Riparian waters, Riparian rights, Beds under water, Navigable waters, High water mark, Watercourses (Legal), Access routes.

Plaintiff sought to establish an easement over defendant ice company's land to have access to a certain lake. The respective titles of each party's property came from a common grantor. Plaintiff claimed that the grantor had reserved title to the lakebed when he transferred title to the strip of land along the lake which defendant owned. Plaintiff claimed such a reservation would naturally have established an easement for access to the lakebed. Defendant conceded an easement would have been established by reserving title to the lakebed but asserted the deed language 'to the lake' and 'along the side' of the lake carried title to the center of the lake. The Court of Appeals of New York, in reversing a lower court decision for plaintiff, held that where a description in a conveyance of riparian land is so framed as to 'touch' the water, rather than run the boundary on dry land, there is a presumption that it carries title to the center of the body of water. The court found that the word 'side' as used in the deed from the common grantor to defendant's predecessor 'touched' the water and thus did not reserve title to the lakebed to the grantor. (Morris-Florida)
W71-02197

TILLSON V CRANE BROOK CO (LIABILITY FOR THE NEGLIGENT LOWERING OF WATER LEVELS).
269 Mass 493, 169 NE 512-513 (1930).

Descriptors: *Massachusetts, *Great ponds, *Withdrawal, *Water levels, Diversion, Damages, Pumping, Relative rights, Competing uses, Judicial decisions, Legal aspects, Dams, Flumes, Low water mark, Bogs, Cranberries, Permits, Canals, Bench marks, Administration, Water level fluctuations.

Plaintiff brought an action to recover damages for the willful or negligent lowering of a great pond which allegedly prevented him from pumping sufficient water therefrom to overflow his cranberry bogs. Plaintiff alleged that defendant removed the flashboards from its flume for the purpose of lowering the water in the pond below the established low water mark. The Supreme Judicial Court of Massachusetts affirmed the lower court's holding for defendant, finding that there was insufficient evidence to warrant a finding for plaintiff that the lowering of the water level in the pond was a result of defendant's negligence. (Barnett-Florida)
W71-02198

YASKILL V THIBAULT (LIABILITY OF LOWER RIPARIAN OWNER FOR BLOCKING STREAM).
273 Mass 266, 173 NE 504-505 (1930).

Descriptors: *Massachusetts, *Natural flow doctrine, *Obstruction to flow, *Watercourses (Legal), Flood damage, Riparian land, Banks, Riparian rights, Waste water disposal, Water pollution, Cesspools, Natural streams, Ponds, Surface waters, Walls, Dams, Diversion dams, Water control, Legal aspects, Judicial decisions, Remedies.

Plaintiff riparian owners sought an injunction against defendant lower riparian owner to require removal of an obstruction which caused water to flood plaintiff's lands. Defendant constructed a cement wall on his land, causing water to back up which ordinarily had flowed away naturally. Defendant contended the water was not a natural stream because there was an area between a pond and a river in which the water spread over level land before returning to a defined bed. Defendant also sought to defend on the basis that plaintiffs had polluted the water by allowing cesspools to drain into it. The Supreme Judicial Court of Massachusetts upheld the lower court's finding that the course was well-defined enough to make it a natural stream. The court also rejected the pollution defenses, stating that such pollution was an independent wrongful act not related to the wrong and injury suffered by plaintiffs. (Morris-Florida)
W71-02199

PUBLIC UTILITIES COMM'N V EAST PROVIDENCE WATER CO (RIGHT OF WATER COMPANY TO RAISE RATES).
136 A 447-455 (RI 1927).

Descriptors: *Rhode Island, *Public Utilities, *Water rates, *Water rights, Administrative agencies, Water supply, Water utilization, Domestic water, Industrial water, Water users, Public rights, Judicial decisions, Legal aspects, Cities, Legislation, Municipal water.

The Rhode Island Public Utilities Commission instituted an investigation into the reasonableness of proposed increased rates filed by a water company and subsequently approved them. The town and fire district affected by the rate increase appealed this approval to the Rhode Island supreme court, and the court reversed. Among the important factors in the court's reversal was evidence that the water company had divested itself of a pond and the water rights in the pond, and also had allowed two companies to pump water from the pond without payment of compensation. The court stated that, when the pond and water rights were acquired by the water company as a public utility, they became devoted to public use. The company could not divest itself of ownership unless such action was clearly in good faith and the property was not necessary for public use. The water company had argued that those taking water without compensation had a right because they were located on the shores of the bond. However, the court rejected this contention. The water rights were exclusively in the owner of the pond. (Duss-Florida)
W71-02200

6F. Nonstructural Alternatives

THE RELATIONSHIP BETWEEN LAND VALUES AND FLOOD RISK IN THE WABASH RIVER BASIN.
Army Engineer Inst. for Water Resources, Alexandria, Va.
For primary bibliographic entry see Field 06B.
W71-01686

FLOOD PLAIN INFORMATION, TUSCARAWAS RIVER, STARK COUNTY, OHIO.
Corps of Engineers, Huntington, W. Va.
For primary bibliographic entry see Field 04A.
W71-01773

FLOOD PLAIN INFORMATION, EAST FORK STONES RIVER, WOODBURY, TENNESSEE.
Corps of Engineers, Nashville, Tenn.
For primary bibliographic entry see Field 04A.
W71-01774

A METHODOLOGY FOR FLOOD PLAIN DEVELOPMENT AND MANAGEMENT.
TRW Systems Group, Redondo Beach, Calif.

Available from NTIS as AD-704 716, $3.00 in paper copy, $0.95 in microfiche. Army Engineer Institute for Water Resources, IWR Report 69-3, December 1969. 185 p. Contract DACW31-68-C-0042.
Identifiers: *Urban planning, Floods, *Floods, Control, Protection, Industries, Hazards, Roads, Dams, Construction, Arizona, Nevada, Reno (Nevada), Tuscon (Arizona), *Flood plains, *Flood plain management.

A methodology is presented by which the consequences (mainly economic in nature) of choosing various flood plain management alternatives may be evaluated so as to achieve a stated set of objectives. The methodology is commonly known as a trade-off analysis. It is illustrated by two case studies, one for the Reno, Nevada area, and the other in the Tuscon, Arizona area.
W71-01872

FLOOD PLAIN INFORMATION-SOUTH FORK OF THE CROW RIVER, HUTCHINSON, MINNESOTA.
Corps of Engineers, St. Paul, Minn.
For primary bibliographic entry see Field 04A.
W71-01915

FLOOD PLAIN INFORMATION, BIG WILLIS CREEK, VICINITY OF GADSDEN, ALABAMA.
Corps of Engineers, Mobile, Ala.
For primary bibliographic entry see Field 04A.
W71-01916

PRINCIPLES AND PROCEDURES IN FLOOD PLAIN MANAGEMENT,
Tennessee Valley Authority, Knoxville.
James E. Goddard, and John W. Weathers.
In: Proceedings, American Society of Civil Engineers, Journal of the Hydraulic Division, Vol 95, No HY4, p 1321-1326, July 1969.

Descriptors: *Flood plains, *Methodology, *Management, *Planning, *Flood control, Coordination, Water resources, Watershed management, Cities.
Identifiers: *Flood plain management, Metropolitan areas, Implementation.

Comprehensive flood plain management is defined as the planning and action to determine, implement, and revise, as needed, plans, for the wise and best use of flood plains and their water resources for the welfare of our nation. The necessity and purpose of changing from the traditional approach is briefly stated. Principles of wise management are presented for communities, cites, metropolitan areas, small watersheds, and large watersheds. Procedures for planning and implementation for the various types of areas ore outlined and examples cited. Flood plain regulations and their role is reviewed. The critical role of close coordination of effort by local, states, and Federal interests is stressed. (Davis-Chicago)
W71-02121

CHAPTER V, FLOOD PLAIN MANAGEMENT AND FLOOD INSURANCE.
For primary bibliographic entry see Field 06B.
W71-02135

COMPUTERS IN FLOOD CONTROL PLANNING,
Kentucky Univ., Lexington. Dept. of Civil Engineering.
For primary bibliographic entry see Field 06B.
W71-02141

STATE FLOOD-PLAIN MANAGEMENT ACTIVITIES,
Oregon State Water Resources Board, Salem.
For primary bibliographic entry see Field 06B.
W71-02147

AMORTIZATION OF NONCONFORMING USES IN FLOOD PLAINS,
Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.
William R. Walker.
Journal of the Urban Planning and Development Division, Proceeding of the American Society of Civil Engineers, Vol 96, UP1, p 1-16, March 1970. 10 ref.

Descriptors: *Amortization, *Flood damage, *Flood plains, *Legal aspects, *Flood plain zoning, *Non-structural alternatives, Planning, City planning, Flood zoning.
Identifiers: *Flood plain management, *Flood damage reduction.

The majority of courts appears to sustain zoning ordinances with amortization provisions for eliminating nonconforming uses if the amortization periods is reasonable and the detriment to the individual is small in relation to the benefits to the public. Condemnation, abandonment, prohibiting or limiting extensions and repairs, and amortization are four methods used to eliminate nonconforming uses. Amortization is presented as the best method of removing nonconformities in the flood plain for purposes of reducing flood damages. Some of the prevalent theories of the court and a brief review of the most cited cases are presented to bring about a better understanding of zoning with an amortization plan. (Davis-Chicago)
W71-02151

6G. Ecologic Impact of Water Development

CONCEPTS AND UTILITIES OF ECOLOGIC MODEL,
Water Resources Engineers, Inc., Walnut Creek, Calif.
Carl W. Chen.
In: Proceedings, American Society of Civil Engineers, Journal of the Sanitary Engineering Division, Vol 96, No SA5, p 1085-1097, October 1970. 7 fig, 3 tab, 19 ref.

Descriptors: *Ecology, *Ecosystems, *Model studies, *Mathematical models, Eutrophication.
Identifiers: *Ecologic model, Acquatic ecosystem.

Basic components of an aquatic ecosystem are modified continuously by such ecologic processes as photosynthesis, respiration, zooplankton grazing, fish predation, nutrient recycling, sedimentation and various transport phenomena. A set of differential equations describing these processes can be assembled and operated simultaneously to model physical, chemical and biological behavior of such ecosystem. Preliminary experiments with an ecologic model of this type indicate the reasonableness of the technique. It is concluded that model development and application will greatly aid a more fundamental understanding of eutrophication processes and their control. (Davis-Chicago)
W71-02115

MATTER OF FORD (COMPENSATION FOR DEPRESSED LAND VALUES WHERE REDUCED WATER SUPPLY UPSET RIVER'S ECOLOGY).
For primary bibliographic entry see Field 06E.
W71-02190

THOMPSON V WATER RESOURCES COMM'N (JUDICIAL REVIEW OF DREDGING PERMIT).
For primary bibliographic entry see Field 06E.
W71-02191

07. RESOURCES DATA

7A. Network Design

SATELLITE (ERTS-A) NETWORK OF GROUND DATA SENSORS: A USER-ORIENTED EXPERIMENT,
Geological Survey, St. Louis, Mo. EROS Program.
Jaems F. Daniel.
Preprint No. 29, Paper presented at National Symposium on Data and Instrumentation for Water Quality Management, Madison, Wisconsin Univ, July 1970. 13 p, 1 fig, 3 tab, 6 ref.

Descriptors: *Satellities (Artificial), *Networks, *Data collections, *Remote sensing, Geology, Hydrology, Water resources, Meteorological data, Meteorology, Hydrologic data.
Identifiers: ERTS.

The intent of providing ground sensor data concurrently with and in the interim of successive image sets from the ERTS-A satellite is to improve the qualitative, semi-quantitative and quantitative interpretations of that imagery. A network of a relatively small number of stations with maximum areal application to provide that data has been designed and sites have been selected. Important to that network are hydrologic sensors as they relate to visual interpretation of imagery and management of water resources. A localized network of sensors to test real-time applications of satellite relayed data will have water quality sensors as a basic ingredient. (Knapp-USGS)
W71-01772

THE SIMULATION OF THE MOVEMENT OF AN INTERFACE BETWEEM SALT AND FRESH WATERS IN A COASTAL AQUIFER BY THE AID OF AN RC ANALOG,
Technion - Israel Inst. of Tech., Haifa. Dept. of Civil Engineering.
G. Dagan.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 111-119, 1969. 9 p, 9 fig, 3 ref.

Descriptors: *Analog models, *Resistance networks, *Saline water-freshwater interfaces, Model studies, Groundwater movement, Simulation analysis, Flow, Porous media.
Identifiers: *Coastal aquifers.

Resistance-capacitance (RC) networks are usually used to simulate the linearized equations of groundwater flow in unconfined aquifers. A similar linerization gives a system of two equations for the flow of fresh and salt waters, separated by an interface, in coastal aquifers. A double resistance network connected by capacitors is proposed to model this system. The voltage difference between the two subnetworks is proportional to the interface elevation. Other different types of analog networks are reviewed. (Knapp-USGS)
W71-01941

7B. Data Acquisition

STOCK ASSESSMENT BY ECHO INTEGRATION AND ITS APPLICATION TO JUVENILE SOCKEYE SALMON IN LAKE WASHINGTON,
Washington Univ., Seattle. Fisheries Research Inst.
For primary bibliographic entry see Field 02H.
W71-01678

SOME RULES USED FOR THE OBSERVATION OF CONCRETE DAMS,
Consulpresa S. A., Madrid (Spain).
For primary bibliographic entry see Field 08A.
W71-01722

FAST-RESPONSE EQUIPMENT FOR ACOUSTIC LOGGING,
For primary bibliographic entry see Field 08E.
W71-01725

SATELLITE (ERTS-A) NETWORK OF GROUND DATA SENSORS: A USER-ORIENTED EXPERIMENT,
Geological Survey, St. Louis, Mo. EROS Program.
For primary bibliographic entry see Field 07A.
W71-01772

A CONDUCTIVITY BRIDGE FOR THE MEASUREMENT OF SALINITY OF SEA WATER,
Woods Hole Oceanographic Institution, Mass.
Alvin L. Bradshaw, and Karl E. Schleicher.
Available from NTIS as AD-699 901, $3.00 in paper copy, $0.95 microfiche. Technical report, No. WHOI-REF-56-20, Mar 1956. 66 p, 17 fig, 14 ref. Bu Ships Contract NObsr-43270.
Identifiers: *Salinometers, Design, Operation, Electrical conductance, Fixed resistors, Capacitors, Wiring diagrams, Impedance bridges, Salinity, Measurement, Sea water.

A sea-going conductivity bridge (Salinometer) for measuring the salinity of sea water is described in considerable detail. In principle, the salinity of an unknown sample is determined by comparing its conductivity with that of a sample of known salinity at the same temperature. The calibration of the bridge is found empirically. The instrument consists of a constant temperature bath, a 1000 cycle impedance bridge using glass conductivity cells in two of its arms, a phase detector to convert the 1000 cycles output of the bridge to DC and a balancing mechanism to complete automatically the fine adjustment in bridge balance. It operates from a a 110 v60 cycle power source.
W71-01877

DIVISION OF ISOTOPES DEVELOPMENT RESEARCH AND DEVELOPMENT PROJECTS: 1969.
Division of Isotopes Development (AEC), Washington, D.C.

For primary bibliographic entry see Field 05A.
W71-01881

CRITERIA FOR RECOGNITION OF ESTUARINE WATER POLLUTION BY AERIAL REMOTE SENSING,
Rhode Island Univ., Kingston. Dept. of Geology.
For primary bibliographic entry see Field 05B.
W71-01900

SPATIAL SPECTRA OF OCEAN SURFACE TEMPERATURE,
National Oceanic and Atmospheric Administration, Miami, Fla. Sea-Air Interaction Lab.
For primary bibliographic entry see Field 02K.
W71-01907

7C. Evaluation, Processing and Publication

USE OF NEW ANALYTICAL METHODS FOR WATER RESOURCE DEVELOPMENT,
Texas Univ., Austin. Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 06A.
W71-01658

MATHEMATICAL PROGRAMMING FOR REGIONAL WATER QUALITY MANAGEMENT,
California Univ., Los Angeles. Graduate School of Business Administration.
For primary bibliographic entry see Field 05G.
W71-01659

DIGITAL COMPUTER CALCULATION OF UNSTEADY OPEN-CHANNEL FLOW (FRENCH),
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
For primary bibliographic entry see Field 08B.
W71-01800

SIMULATION OF FLOOD PROPAGATION BY DIGITAL COMPUTER AND ITS APPLICATION TO RIVER PROBLEM,
Central Research Inst. of Electric Power Industry, Tokyo, (Japan).
For primary bibliographic entry see Field 08B.
W71-01802

DIGITAL SIMULATION IN HYDROLOGY AND ITS ROLE IN HYDROLOGIC EDUCATION,
Stanford Univ., Calif. Dept. of Civil Engineering.
Ray K. Linsley.
In: The Progress of Hydrology, Vol 2 - Specialized Hydrologic Subjects, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 563-571, published by Univ. of Illinois, 1969. 9 p, 1 fig, 7 ref.

Descriptors: *International Hydrological Decade, Conferences, *Simulation analysis, *Synthetic hydrology, *Computer programs, Reviews, Routing, Rainfall-runoff relationships, Forecasting, Hydrology, Hydraulics, Planning, Projects, Research facilities, Education, Laboratories, Model studies, Technology, Computers, Instrumentation.
Identifiers: *Water resources research, Stanford Watershed Model.

Simulation models of river basin hydrology are briefly reviewed. Simulation models employ functions which are chosen with a view to describing the hydrologic process with reasonable accuracy and yet are susceptible to rapid solution on the digital computer. Development of the Stanford Watershed Model has had a significant impact on hydrologic education at Stanford. The contributions of SWM to hydrologic education at Stanford have occurred in a number of ways. Basically these may be grouped under three headings: organizing instruction around the flow diagram of the Stanford Watershed Model as a basic functional description of the hydrologic cycle; providing greater opportunity for students to explore hydrologic processes via digital simulation; and providing a base for a variety of research projects in hydrology. In addition to its use as a basis of discussion, the SWM permits rapid determination of the effects of various factors on the hydrologic process. Starting from some reference conditions one may investigate the effect of altering rainfall amount or intensity, antecedent soil moisture, potential evaporation, number of precipitation stations, changes in land use, changes in channel conditions and many other factors. The consequences of such changes on the streamflow hydrograph, soil moisture, actual evapotranspiration or suspended sediment outflow may be determined for a single storm or during a month or year. If snow is involved, the effect of altering wind, dewpoint, insolation or initial snowpack on patterns of snowmelt or streamflow may be evaluated. (Knapp-USGS)
W71-01820

HYDROLOGIC DATA REDUCTION TECHNIQUES AND UNIT CONVERSIONS FOR USE IN THE OGRE, T-WAVE, FLIP, AND RAVE FLUID FLOW CODES,
California Univ., Livermore. Lawrence Radiation Lab.
For primary bibliographic entry see Field 02F.
W71-01887

A PROCEDURE FOR COMPUTING AND DISPLAYING TIME VARYING POWER SPECTRA ILLUSTRATED BY APPLICATION TO A GEOPHYSICAL PROCESS,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
Donald G. Wilson.
Chesapeake Bay Institute Technical Report 67, Reference 70-7, Johns Hopkins University, August 1970. 37 p, 15 fig, 7 ref. ONR Research Prog NR 083-016, Contract N00014-67-A-0163-0006.

Descriptors: *Time series analysis, *Statistical methods, *Spectroscopy, Geophysics, Ocean waves, Digital computers, Water pressure, Remote sensing, Mathematical models, Equations, Data processing, Statistics, Data storage and retrieval, Telemetry, Data transmission.
Identifiers: Computer graphics.

Computing time-dependent power spectra is an important method for studying non-stationarities in signals. An efficient procedure for computing such spectra and displaying them immediately is requisite for effective application. The method presented is based on a data window which moves along the signal in unit increments. The spectrum is updated for each new sample. All spectra are displayed on a computer graphic terminal and the algorithm was deliberately constructed to make computer graphic display efficient. (Woodard-USGS)
W71-01910

SEAMAP DEEP-SEA CHANNEL,
Pacific Oceanographic Lab., Seattle, Wash.
Paul J. Grim.
For sale by Superintendent of Documents, U S Government Printing Office, Wash, D C 20402 - Price $0.35. Environmental Science Services Administration (ESSA) Report ERL 93-POL 2, January 1969. 27 p, 9 fig, 21 ref.

Descriptors: *Sedimentation, *Erosion, *Channel erosion, *Turbidity currents, *Ocean currents, Channel flow, Ocean circulation, Turbidity, Sediments, Channel morphology, Graduation, Profiles, Contiental slope, Marine geology, Littoral drift, Sediment transport, Alaska, Pacific Ocean.
Identifiers: Abyss, Aleutian trench, Axial profile, Graphs, Tectonic activity (Aleutians).

The SEAMAP deep-sea channel is a relic feature on the Aleutian abyssal plain south of the Aleutian trench. Along most of its 370-km length it has well-developed levees that are generally asymmetrical and differ in height. Typically the channel is about 50 m in depth and/6km in width. From its northern end on the south wall of the Aleutian trench the channel floor rises towards the southwest from a depth of 4800 m to a minimum depth of 4590 m near its midpoint. Continuing in the same direction it deepens again to 4750 m. This gradient reversal precludes turbidity currents from flowing through the channel and supports the thesis that the Aleutian abyssal plain is a relic feature that has been cut off from its supply of turbidite material by the downbowing of the Aleutian trench. The channel apparently has been destroyed by slumping on the south wall of the trench north of the 4800-m countour. For much of its length, it is subparallel to the trench and from a topographic standpoint occupies the crest of the outer ridge south of the trench. (Woodard-USGS)
W71-01919

THE ENCROACHMENT OF THE SALT WATER IN KOITO RIVER MOUTH RESERVOIR,
Chiba Prefecture Industrial Water Dept. (Japan); and Mitsui Consultants Co., Ltd., Tokyo (Japan).
For primary bibliographic entry see Field 02L.
W71-01942

08. ENGINEERING WORKS

8A. Structures

RELATIVE EFFECT OF WAVES GENERATED BY LARGE SHIPS AND SMALL BOATS IN RESTRICTED WATERWAYS,
California Univ., Berkeley, Hydraulic Engineering Lab.
For primary bibliographic entry see Field 08B.
W71-01664

GEISERT V CHICAGO R I AND P RY (SERVIENT LANDS MUST SUFFER CONSEQUENCES OF UNRESTRAINED FLOW OF DRAINAGE FROM DOMINANT ESTATES).
For primary bibliographic entry see Field 06E.
W71-01674

SOME RULES USED FOR THE OBSERVATION OF CONCRETE DAMS,
Consulpresa S. A., Madrid (Spain).
J. L. Serafim, and M. Guerreiro.
Water Power, Vol 22, No 5/6, p 181-189, May-June, 1970. 9 p, 7 fig, 1 tab, 11 ref.

Descriptors: Dams, *Concrete dams, *Performance, Instrumentation, Data collections, Structural behavior, Safety, Inspection, Foreign countries, Operation and maintenance, Control systems, Displacements, Deformation, Seepage, Settlement (Structural), Measuring instruments, Measurement, Behavior, Uplift pressure.
Identifiers: Procedures, Reports, Spain.

Experience gained in observing the performance of concrete dams in Spain over a 5-yr period is described. Typical cases presented are: (1) existing dams with and without observation systems; (2) control of the behavior of dams from the first total loading; and (3) observations of dams instrumented by a department organized for such work. Procedures followed in each case are indicated, special attention being given to the organization of the observation work, inspection of the dam, and study of special problems and their consequences at the time of first loading. Observation methods and a procedure to simplify and reduce the work of calculations and diagrams are indicated. Present observation techniques make possible the behavior control of any dam not having an observation system, regardless of age or type. Recommended procedure for establishing the observation of a dam is: (1) assemble relevant design and construction documents; (2) inspect the dam; (3) report on the

type of observation system to be installed; (4) elaborate the observation plan; and (5) install the apparatus and fulfill the program of readings and measurements. (USBR)
W71-01722

CONCRETE PLACEMENT (SPLIT LEVEL - NO VERTICAL JOINT SCHEME),
For primary bibliographic entry see Field 08F.
W71-01723

MANAPOURI POWER PROJECT: TAILRACE TUNNEL CONSTRUCTION,
Bechtel Pacific Corp. Ltd., Bluff (New Zealand).
S. E. Brooks.
N Z Eng, Vol 25, No 5, p 120-124, May 1970. 5 p, 2 fig.

Descriptors: *Tailrace, *Tunnels, Tunnel linings, Surge tanks, *Tunnel construction, Tunnel design, Rock bolts, Alinements, Foreign construction, Compressed air, Ventilation, Dewatering, Construction, Tunneling, Construction equipment.
Identifiers: Manapouri Project, New Zealand, Blasting, Construction methods, Tunnel supports.

The Manapouri turbines discharge to the sea through a 6-1/4-mi-long tailrace tunnel that is a concrete-lined, 30-ft-dia horseshoe section with a flat invert. A surge chamber and shaft accommodate any surge action. Tunnel design, preliminary construction work, excavation methods, drainage and pumping problems, blasting and mucking procedures, and tunnel lining operations are described. Preliminary on-shore work started at Deep Cove, New Zealand, in Sept 1963, with the first shot being fired in Feb 1964, and the tunnel ready for service at the end of Aug 1969. Seven major fault zones were encountered in the tunnels length. (USBR)
W71-01734

THE CLYWEDOG RESERVOIR PROJECT,
Halcrow (William) And Partners, London (England).
A. E. Fordham.
J Inst Water Eng, Vol 24, No 1, p 17-76, Feb 1970. 63 p, 21 fig, 1 tab, 13 ref, 3 append, 15 disc.

Descriptors: Dams, Contrete dams, *Buttress dams, Dam foundations, *Dam construction, Preliminary investigations, *Dam design, Concrete placing, Design criteria, River basin development, Water resources development, Foreign construction, Project planning, Construction, Concrete control, Scheduling, Planning, Design flood.
Identifiers: Great Britain, *Clywedog Dam, Great Britain, Construction control, Construction methods.

Clywedog Dam is a 220-ft-high, 730-ft-long concrete buttress dam located on the Clywedog River in Great Britain. The history and description of the project from initial planning to the first filling of the reservoir are presented. The basic aims of the structural design of the dam were: (1) the effective slenderness ratio of buttresses should not exceed about 10; (2) based on conventional linear analysis, maximum principal compressive stress should not exceed 490 lb/sq in. and there should be no tension; (3) the ratio of horizontal thrust from the water to the weight of a buttress should not exceed 0.85 at the foundation; and (4) loads on the foundation should not exceed 18 tons/sq ft. Linear analysis was checked by a more eleborate finite element analysis which was shown to be advisable by readings of stress and strain gages installed during construction. Construction planning, procedures, and control are described. The bulk of concrete in the dam was placed by a 10-ton cableway equipped with a fixed-head mast and a tail carriage that traveled along a track long enough for the burden rope to cover the entire dam area. Concrete was specified by strength, and few problems were encountered with temperature control using ordinary portland cement. (USBR)
W71-01738

TECHNOLOGY OF CONSTRUCTING CANALS WITH POLYMER MEMBRANE LININGS,
For primary bibliographic entry see Field 08G.
W71-01739

LOUISVILLE AND N RR V SALTZER (RAILROAD'S LIABILITY FOR BANK EROSION CAUSED BY REROUTING OF RIVER).
For primary bibliographic entry see Field 06E.
W71-01744

HEARINGS AND REPORT ON AMENDMENT TO THE WATERSHED AND FLOOD PREVENTION ACT BEFORE THE SUBCOMMITTEE ON CONSERVATION AND CREDIT, COMMITTEE ON AGRICULTURE, US HOUSE OF REPRESENTATIVES, 88TH CONG, 2ND SESSION.
For primary bibliographic entry see Field 06E.
W71-01751

GLORE V HAGGARD (IMPLIED EASEMENT TO MAINTAIN PIPELINE FOR EXERCISE OF WATER RIGHTS).
For primary bibliographic entry see Field 06E.
W71-01753

TWIN FALLS CANAL CO V AMERICAN FALLS RESERVOIR DIST NO 2 (DIVERSION OF UNAPPROPRIATED WATER).
For primary bibliographic entry see Field 06E.
W71-01861

RUMANIAN IRRIGATION.

Engineering News Record, Vol 185, No 23, p 13, December 3, 1970. 1 p.

Descriptors: *Irrigation systems, *Irrigation engineering, *Hydraulic design, Economics, Operation and maintenance, Canals, Pipes, Automatic control, Penstocks.
Identifiers: Rumania, Danube Plain.

A $52 million irrigation system under construction in Rumania's Danube Plain, southwest of Bucharest, will ultimately provide water to 200,000 acres. Crop output could be more than doubled by the system. London-based consultants say water will be pumped from the Danube River into an unlined canal that crosses the floodplain. An automatic main pumping station with 8 pumps will force water at 1,530 cfs up a 3-mile long steel penstock with a static lift of 232 ft. The water will flow in lined gravity canals 5 miles to a second pumping station where 5 pumps will lift the water 85 ft through a 2-mile long penstock into the final distribution level. The system will be automated for maintaining constant volume, and 156 secondary pumping stations located throughout the system will help monitor the flow of water. In the event of power failure or too much water in any part of the works, wiers will close automatically to reduce or stop the flow. (Lang-USGS)
W71-01905

DE KALB COUNTY V TENN ELEC POWER CO (LIABILITY FOR FLOOD DAMAGE CAUSED BY DAM OVERFLOW DURING UNPRECEDENTED FLOOD).
For primary bibliographic entry see Field 06E.
W71-01965

A PRELIMINARY STUDY OF THE COST OF TUNNEL CONSTRUCTION,
Road Research Lab., Crowthorne (England).
G. Margason, and R. G. Pocock.
Available from NTIS as PB-194 133, $3.00 in paper copy, $0.95 in microfiche. RRL Report LR 326, 1970. 5 tab, 49 ref.

Descriptors:
Identifiers: *Vehicular tunnels, Construction costs, Tunneling, Excavation, Soils, Tunnel linings, Great Britain.

A preliminary study has been made to obtain information on the broad breakdown of the price of driven-tunnel construction. Only the direct engineering prices of construction are discussed and no consideration is given to any indirect costs or benefits associated with sub-surface roads.
W71-02053

SPECIAL REPORT: COOLING TOWERS.
For primary bibliographic entry see Field 05D.
W71-02064

CITY OF COVINGTON V STATE TAX COMM'N (ASSESSMENT OF SUBMERGED LAND FOR TAXING PURPOSES).
For primary bibliographic entry see Field 06E.
W71-02127

8B. Hydraulics

A MULTIVARIATE STATISTICAL MODEL FOR ESTIMATING THE NUMBERS, SIZES,AND INTERFLUVIAL DISTANCES OF STREAMS WITHIN A RELATIVELY HOMOGENEOUS DRAINAGE AREA.
Naval Postgraduate School, Monterey, Calif.
For primary bibliographic entry see Field 02E.
W71-01662

RELATIVE EFFECT OF WAVES GENERATED BY LARGE SHIPS AND SMALL BOATS IN RESTRICTED WATERWAYS,
California Univ., Berkeley, Hydraulic Engineering Lab.
M. M. Das.
Available from NTIS as AD-704 298, $3.00 in paper copy, $0.95 in microfiche. Report No. HEL-12-9, November 1969. 41 p, 6 tab, 64 fig, 64 ref. Army DACW72-68-C-0034.
Identifiers: *Ships, *Water waves, *Boats, Water waves, Hydrodynamics, Insland waterways, Harbors, Erosion, Piers, Floating docks, Cargo ships, Energy, Velocity.

The peak wave energy in a system of waves resulting from the passage of a ship is important in engineering problems such as bank erosion, the motion of moored vessels, and forces on fixed and floating docks. With respect to bank erosion, the question often asked is whether the single passage of a large ship is more damaging than numerous passages of small pleasure craft. The study was conducted to determine the relative importance of the peak energy resulting from the passage of a cargo ship and a pleasure cruiser. The characteristics of the waves generated by these vessels moving at various speeds in deep and shallow water were determined from model studies. A numerical example is given in which prototype values of peak wave energy were predicted from the model data, and then ratios of the peak energies computed. The importance of ship speed is evident in these comparisons.
W71-01664

DETRIMENTAL EFFECTS OF NATURAL SOIL AND WATER ELEMENTS ON DRAINAGE PIPE STRUCTURES IN ALABAMA,
Geological Survey, Tuscaloosa, Ala. Water Resources Div.
Luther W. Hyde, Victor M. Shamburger, Jesse S. Ellard, and Rubin E. Pate.
Available from NTIS as PB-189 373, $3.00 in paper copy, $0.95 in microfiche. Alabama Highway Research Report No. HPR-40, 1969. 152 p, 7 tab, 80 ref, 35 fig.
Identifiers: *Roads, Surface properties, *Skidding, Test equipment, *Trailers, Design, Friction, Towing vehicles. Water, Vibration, Velocity, Recording

systems, Control panels, Power, Calibration, Bituminous coatings, Asphalt, Concrete, Louisiana, Evaluation Skid numbers, *Skid resistance.

Field studies were conducted in Alabama on soil and water parameters to determine their relationship to culvert pipe corrosion. The types of culvert materials, investigated included concrete, galvanized steel, bituminous-coated galvanized steel, aluminum, bituminous-coated aluminum, pitch-impregnated fiber, cast iron, and vitrified clay. Water parameters measured included pH, oxidation-reduction potential, dissolved oxygen, resistivity, etc. Soil parameters determined were pH, oxidation-reduction potential, resistivity, and geologic conditions. Soil parameters generally were less significant than water parameters in the corrosion of culverts. A graphical method based on pH, resistivity, and dissolved oxygen content of water was devised for estimating life expectancy of steel pipe. Galvanized pipe is not recommended for use in run-off water of low resistivity, low pH or high dissolved oxygen content unless effectively coated with bituminous material. Aluminum pipe was found to be less affected by acidic waters than galvanized steel but less resistant to abrasion effects. With the exception of areas affected by acid mine drainage, concrete pipe was highly resistant to corrosion. Pitch-fiber pipe as well as corrugated cast iron and vitrified clay performed exceptionally well.
W71-01676

HYDRAULIC MODEL STUDIES OF SILVER JACK DAM SPILLWAY STILLING BASIN, BOSTWICK PARK PROJECT, COLORADO,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
T. J. Rhone.
Available from NTIS as PB-190 279, $3.00 in paper copy, $0.95 in microfiche. REC-OCE-70-3, January 1970. 22 p, 11 fig, 2 ref.
Identifiers: Silver Jack Dam, Bostwick Park (Colorado), *Stilling basins, *Spillways, *Dams, Hydraulic models, Colorado, Design, Model tests, Pipes, Baffles.

A massive landslide destroyed the nearly completed spillway stilling basin at Silver Jack Dam in Colorado. A circular curve in an inclined plane was used to connect the undamaged approach conduit and the relocated stilling basin. Hydraulic model studies were performed to assure satisfactory flow conditions in the conduit and stilling basin under limited tailwater conditions and with unsymetrical approach flow resulting from a circular curve in the upstream conduit. A deflector vane was installed in the crown of the tunnel downstream from the curve to prevent the flow from crossing over the top and sealing the portal. Vanes were developed for the stilling basin approach chute to improve flow distribution in the basin. Unique daffle blocks were developed to provide good energy distribution in a basin that had insufficient tailwater depth to form a conventional hydraulic jump. Pressure measurements were made on the conduit bend, conduit vane, chute vanes, and baffle blocks.
W71-01694

OPEN CHANNEL EXPANSIONS FITTED WITH LOCAL HUMP,
Sir George Williams Univ., Montreal (Quebec); And Indian Inst. of Science, Bangalore.
A. S. Ramamurthy, S. Basak, and P. R. Rao.
Proc Amer Soc Civ Eng, J Hydraul Div, Vol 96, No HY5, p 1105-1113, May 1970. 9 p, 6 fig, 1 tab, 7 ref, 2 append.

Descriptors: Channels, Channel erosion, Channel flow, Reynolds number, *Flow separation, *Expansion, Open channel flow, Hydraulics, Subcritical flow, Fluid mechanics, Transition flow, *Transitions (Structures), *Open channels, Deceleration, Velocity distribution, Laboratory tests, Erosion control, Flow control, Eddies, Roughness (Hydraulic).
Identifiers: Eddy currents.

Flow in channel expansions tends to separate while subjected to the adverse pressure gradient associated with flow deceleration. Flow separation causes eddying and erosive attack on the downstream channel. Tests show that a local hump set in the bottom profile of an expansion decreases the incidence of flow separation and diminishes erosive action. The specific energy diagram is used to describe the action of the hump. Sectional views of normalized velocity contours for a test flume with and without humps at several values of Reynolds number are presented. Plan views of normalized velocity distribution curves for the test flume with and without humps are presented for large Reynolds numbers. (USBR)
W71-01731

PRESSURE SURGE ATTENUATION UTILIZING AN AIR CHAMBER,
Kentucky Univ., Lexington.
D. J. Wood.
Proc Amer Soc Civ Eng, J Hydraul Div, Vol 96, No HY5, p 1143-1156, May 1970. 14 p, 10 fig, 10 ref, 2 append.

Descriptors: Water hammer, Hydraulics, *Surges, *Unsteady flow, Fluid mechanics, Oscillation, Pulsating flow, *Air chambers, *Attenuation, Analysis, Performance tests, Pipelines, Pipe flow, Closed conduit flow, Analytical techniques.
Identifiers: Wave propagation, Transient flow, Pressure waves, Surge waves, Pipeline surges.

The effect of a single air chamber on the propagation of a pressure surge in a line is investigated. The pressure surge is generated by rapid closure of a downstream value. A distributed parameter wave analysis and a lumped parameter slug flow analysis are formulated to describe the transient flow situation. Short-term effects are not predicted by a lumped parameter analysis, but are important; the magnitude of the short-term surge may be many times greater than that predicted by a lumped parameter analysis. The optimum design of an air chamber is possible, and is dependent on short-term effects. Experimental results were in close agreement with those predicted. The performance of an air chamber must be evaluated relative to a specific application; an accurate transient analysis is necessary and can be accomplished using the approach described. (USBR)
W71-01732

SURGE AND AIR ENTRAINMENT IN PIPELINES,
Bureau of Reclamation, Denver, Colo.
L. H. Burton, and D. F. Nelson.
Pap, Inst Contr Flow Closed Conduits, Colo State Univ, Aug 1970. 40 p, 25 fig, 9 ref.

Descriptors: *Air entrainment, *Surges, *Pipelines, Closed conduits, Closed conduit flow, Distribution systems, Fluid flow, Control, Vents, Upstream, Check structures, Oscillation, Air traps, Analysis, Control systems, Water conveyance.
Identifiers: *Coachella Distribution System, Calif, *Canadian River Project, Tex, Pipestands.

The Bureau of Reclamation has constructed 2 closed conduit water conveyance systems using upstream control. They are the Coachella Valley Distribution System in southern California and the Canadian River Project in northwestern Texas. Operational problems in the 2 systems, laboratory and field tests conducted before and after construction, and solutions adopted for surge and air entrainment problems during design and construction are reviewed. Problems in upstream control systems have been more severe than in downstream control systems. An upstream control system is feasible for economical reasons where the topography lends itself to such a system. Past experience and better tools for analysis will reduce the magnitude of future problems in upstream control systems. Future systems are discussed, including methods of analysis for surging and air entrainment, and types of strucutres that may be used. (USBR)
W71-01737

GAUGING AND SAMPLING INDUSTRIAL WASTE WATER (OPEN CHANNEL),
Department of Water Resources, New York. Bureau of Water Pollution Control.
For primary bibliographic entry see Field 05A.
W71-01757

PREDICTION OF ORIFICE DISCHARGE AND HEAD LOSS ALONG A SMALL DIAMETER TERMINAL PERFORATED PIPE,
New Mexico State Univ., University Park. Dept. of Civil Engineering.
Frank H. Jones.
M. S. Thesis, New Mexico State University, March 1969. 45 p, 10 fig, 7 tab, 21 ref, 1 append. OWRR Project A-006-NMEX (2).

Descriptors: *Head loss, *Subsurface irrigations, *Plastic pipes, *Orifices, Irrigation water, Pipes, Orifice flow, Pipe flow, Darcy-Weisbach equation, Equations, Discharge coefficients.
Identifiers: Perforated pipes, Head loss prediction.

A prediction equation was developed to be used to predict the head loss occurring along a one-half inch perforated polyethelene plastic pipe, the leading type used in subsurface irrigation systems. An equation which was developed experimentally shows the head loss to be approximately 70% of that predicted by a measured value of the Darcy-Weisbach friction factor on a similar unperforated pipe. A prediction equation was also developed for orifice flow through the pipe perforations. Orifices were drilled with a thirty-thousandths of an inch diameter bit and the coefficient of discharge was found to be 0.612. It was found that with careful preparation, the Christiansen uniformity coefficient of ninety to ninety-five percent could be obtained for orifices under the same head. (Knapp-USGS)
W71-01776

SOME MORPHOMETRICAL RELATIONSHIPS IN THE MIDDLE AND LOWER REACHES OF THE AMU DARYA,
Sredneazuatsjuu Bauchno-Issledovatelskii Institut Irrigatsii, Tashkent (USSR).
A. M. Mukhamedov, and H. A. Ismaghilov.
In: Proceedings 13 th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 5-1 (Seminars), Science Council of Japan, Kyoto, p 191-194, 1969. 4 p, 1 fig, 2 tab, 7 ref.

Descriptors: *Channel morphology, *Alluvial channels, Rivers, Sediment transport, Bed load, Sediment load, Suspended load, Scour, Erosion, Discharge (Water), Sediment discharge.
Identifiers: Amu Darya River (USSR).

The Amu Darya is the largest river of Central Asia. Flood discharges of the Amu Darya River vary from 5,000 to 10,000 cu m/sec. Low water discharges vary from 200 to 300 cu m/sec. The difference between the flood level and the low water level amounts to 2.5 to 3 m. The river carries a very large amount of suspended sediments and bedload. Long-term mean density of suspended sediment in the lower reaches is 2.56 kg/cu m, while the highest density of suspended sediment is as high as 13 kg/cu m. The channel is in a state of continuous change due to a steep slope (0.00015-0.00035), high velocities of the flow (up to 2.5 to 3.5 m/sec.), instability of the hydrograph throughout the year, and especially during the high water period, and an extreme instability of the channel, which is formed of erodible fine sands of 0.10 to 0.0 mm diameter. (Knapp-USGS)
W71-01779

MORPHOLOGICAL PRINCIPLE OF MODELLING RIVER-BED PROCESS,
State Hydrological Inst., Leningrad (USSR).
N. S. Snamenskaya.
In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 5-1 (Seminars),

Science Council of Japan, Kyoto, p 195-200, 1969. 6 p, 2 fig, 3 ref.

Descriptors: *Hydraulic models, *Hydraulic similitude, *Sediment transport, Alluvial channels, Model studies, Sands, Density, Discharge (Water), Sediment discharge, Sedimentary structures.
Identifiers: Movable-bed models.

To study problems of river bed deformation on rivers with structures of economic importance, it is often necessary to use movable-bed models. Techniques developed for the study of stream hydraulics on rigid models cannot be applied easily to movable-bed models. For good scaling, sand must be replaced by lighter material or water discharge must be increased relative to that estimated by F number, which depends to some degree on intuition. The type of substitute affects the shape of dunes and the rate of sediment transport; therefore it is not easy to choose what substitute to use. Methods of calculating sediment density and water discharge relationships for the best scale factors are briefly discussed. (Knapp-USGS)
W71-01780

A BASIC CAUSE OF A BRAIDED CHANNEL,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02J.
W71-01781

SIMULATION OF RIVER BED VARIATION IN MOUNTAINOUS BASIN,
Osaka Univ. (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02A.
W71-01782

ON THE GEOMETRICAL CHARACTERISTICS OF SAND WAVES,
Kyoto Univ. (Japan). Disasters Prevention Research Inst.
Yuichiro Tanaka.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 5-1 (Seminars), Science Council of Japan, Kyoto, p 249-255, 1969. 7 p, 6 fig, 7 ref.

Descriptors: *Sand waves, *Meanders, *Sediment transport, *Bed load, *Uniform flow, Sands, Turbulent flow, Regime, Hydraulic models, Alluvial channels, Open channel flow, Channel morphology.
Identifiers: Japan, Transverse water-surface oscillations.

A mathematical analysis was made of the length and height of sand waves formed on a movable bed in open channels under the condition of uniform flow. The mean length of alternating bars in straight channels and the meander length of meandering streams are related to the flow parameters using the oncept of transverse oscillations of the water surface. The height of sand waves in the equilibrium state for the low flow regime is determined by the flow parameters using the shallow-water approximation for the fluid and the continuity equation for sediment transport. The theory seems to give a reasonable explanation of the variation of the height of sand waves with the flow conditions. These analytical results are compared with experimental data obtained from measurements in experimental flumes and in rivers, with generally good agreement. (Knapp-USGS)
W71-01783

ON THE MEAN VELOCITY FORMULAS OF RIVERS,
Tokushima Univ. (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W71-01784

CHANGES OF TOP-SET-BED IN A SILTED RESERVOIR,
Nagoya Univ. (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02J.
W71-01785

VARIATION OF ROUGHNESS DURING DEGRADATION,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
H. W. Shen, and B. Suryanarayana.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 5-1 (Seminars), Science Council of Japan, Kyoto, p 277-280, 1969. 4 p, 1 fig, 2 ref. NSF Research Grant GK-0549.

Descriptors: *Roughness (Hydraulic), *Variability, *Stream erosion, *Degradation (Stream), Sediment transport, Model studies, Flumes, Sediments, Particle size, Particle shape, Equations.

The variation of roughness during a degradation study in a laboratory flume was found to be the same as that of the equilibrium flow. During degradation, the form resistance increased for sand finer than 0.6 mm and decreased for sand coarser than 0.6 mm. At the end of degradation, Shield's criterion for incipient motion was valid for sand coarser than 0.6 mm when the bed was plane and it was not valid for sand finer than 0.6 mm when the bed was rippled. (Woodard-USGS)
W71-01786

PROBLEMS OF TWO-PHASE FLOW THEORY,
Novosibirsk State Univ. (USSR).
Oleg F. Vasiliev.
In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 5-3 (General Lectures, Records of Congress, Social Events and Study Tours), Science Council of Japan, Kyoto, p 39-84, 1969. 46 p, 94 ref.

Descriptors: *Sediment transport, *Open channel flow, *Rheology, *Hydrodynamics, *Theoretical analysis, Reviews, Mathematical studies, Equations, Erosion, Runoff, Streamflow, Turbulent flow, Flow rates, Sediment load, Suspended load, Sediment distribution, Settling velocity, Gravity, Sedimentation, Particle size, Diffusion, Fluid mechanics, Viscosity, Foreign projects.
Identifiers: *USSR, *International Association for Hydraulic Research.

A review of hydrodynamic theories of sediment transport in open-channel flow is presented from material developed primarily from research that has been done in the Soviet Union. Methods of deriving equations related to two-phase flow are described. In the thirties the turbulent diffusion theory was developed in application to the movement of suspended load in open channels, first by V.M. Makkaveyev (1931) and M.P. O'Brien (USA,1933), and later was published on by others. The chief shortcoming of the theory is that it considers suspended particles as a passive substance which, is carried by, but exerts no dynamic response on the flow of the transporting fluid. Significant progress in establishment of a theory of turbulent multicomponent flows came about in the fifties with publication by F. I. Frankle's theory and work by others. (Woodard-USGS)
W71-01789

DIFFUSION OF HORIZONTAL BUOYANT JET DISCHARGED AT WATER SURFACE,
Tokyo Univ. (Japan).
For primary bibliographic entry see Field 05B.
W71-01790

DEEPENING THE APPROACH CHANNEL TO THE PORT OF COCHIN, INDIA,
Central Water and Power Research Station, Poona (India). Tidal Hydraulics Div.
C. V. Gole, and P. P. Vaidyaraman.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 233-240 1969. 8 p, 3 fig.

Descriptors: *Harbors, *Silting, *Saline water intrusion, Mixing, Sedimentation, Stratified flow, Density currents, Saline water-freshwater interfaces, Dredging, Channel improvement, Desilting, Hydraulic models, Model studies.
Identifiers: Cochin (India).

The Port of Cochin, on the west coast of India has an approach channel 21,000 ft. long and 450 ft. wide, which is maintained to a depth of -32 ft. In order to accommodate super tankers, it is proposed to deepen the channel to -45 ft. and widen it to 600 ft. Because the flood discharges of the various rivers find their way into the sea through the harbor area, strong density effects result from mixing tidal and fresh water flows. The formation of a salt water wedge is responsible for the high rate of siltation at Cochin. The effects of deepening and widening the channel were studied in a saline water model with a fresh water discharge of 66,000 cfs. As a result of the proposed deepening, the salt water wedge would move upstream and there would be an increase in the quantity of maintenance dredging. (Knapp-USGS)
W71-01792

HYDRAULIC AND SEDIMENTARY PROBLEMS IN TIDAL ESTUARIES,
Laboratorio Nacional de Engenharia Civil, Lisbon (Portugal).
For primary bibliographic entry see Field 02L.
W71-01795

STUDY OF THE INFLUENCE OF A DAM, BUILT IN A TIDAL ESTUARY, ON ITS TIDAL CHARACTERISTICS,
Laboratorio Nacional de Engenharia Civil, Lisbon (Portugal).
Fernando M. Abecasis, and Ildeberto B. Mota Oliveira.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 283-291, 1969. 9 p, 3 fig, 4 ref.

Descriptors: *Tidal effects, *Estuaries, *Currents (Water), Water circulation, Sediment transport, Scour, Sedimentation, Dams, Streamflow, Regime, Hydroelectric plants, Hydroelectric power, Tailwater, Mathematical models.
Identifiers: Douro River (Portugal).

The construction of a dam 20 Km upstream of the mouth of the Douro river, near Oport city in Portugal will sensibly affect the tidal regime of its estuary, resulting as the most noticeable consequence, in a diminished natural flushing ability of the tidal currents. Tidal propagation in the estuary was studied by a finite-difference method. The natural flushing ability of the mouth of the river during dry season, for a spring tide, with a constant turbine discharge, is of the order of 50% of that corresponding to the natural river regime. This value falls to 20% when the turbine discharge is concentrated in a four hour period during low-water. Flushing increases to 120% when the discharge period is centered over mid-ebb. (Knapp-USGS)
W71-01797

MATHEMATICAL SIMULATION OF TWO-DIMENSIONAL HORIZONTAL CONVECTIVE-DISPERSION IN WELL-MIXED ESTUARIES,
Texas Univ., Austin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02L.
W71-01798

FLUME STUDY ON SALINITY INTRUSION IN ESTUARIES,
Waterloopkindig Laboratorium, Delft (Netherlands).

For primary bibliographic entry see Field 02L.
W71-01799

DIGITAL COMPUTER CALCULATION OF UNSTEADY OPEN-CHANNEL FLOW (FRENCH),
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
Andre Chervet, and Pierre Dalleves.
In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 259-266, 1969. 8 p, 6 fig, 6 ref.

Descriptors: *Computer programs, *Unsteady flow, *Open channel flow, *Flood forecasting, *Waves (Water), Discharge (Water), Model studies, Surf, Bores, Hydrographs, Surges.
Identifiers: Method of characteristics.

An example is given of the use of digital computers in the numerical treatment of unsteady flow in open channels. A computer program was written at the Swiss Federal Laboratory for Hydraulic Research to calculate the flood resulting from the sudden release of storage water. It also calculates the propagation of long waves on a beach. The computation is carried out by the method of characteristics. The program calculates the path of the wave-front, the flooded areas, water levels, and discharge at any time and distance. In order to determine the limits of validity for the computing method, a comparison between the results of computation and model studies was made for the sudden release of storage water in an extremely steep and irregular alpine valley. The results of computation are in good agreement with the measured values. (Knapp-USGS)
W71-01800

ON THE SIMULATION OF RIVER-BED VARIATION BY CHARACTERISTICS,
Public Works Research Inst., Tokyo (Japan).
Kyozo Suga.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1, (Subject A), Science Council of Japan, Kyoto, p 289-296, 1969. 8 p, 4 fig, 2 ref.

Descriptors: *Unsteady flow, *Streamflow forecasting, *Mathematical studies, *Open channel flow, Waves (Water), Surges, Channel morphology, River beds.
Identifiers: Method of characteristics.

The characteristics method was applied to river-bed analysis for the cases of unsteady flow in rectangular channels and steady flow in compound channels. In normal calculation of river-bed variation, water current is often treated as steady flow with sufficient precision, even when flood waves and tidal levels are considered. However, when release of stored water is the source of unsteadiness, as in collapse of dams or the break of estuary sandy areas, no simplifications in basic equations are desirable. (Knapp-USGS)
W71-01801

SIMULATION OF FLOOD PROPAGATION BY DIGITAL COMPUTER AND ITS APPLICATION TO RIVER PROBLEM,
Central Research Inst. of Electric Power Industry, Tokyo, (Japan).
Shinobu Koreeda, and Tamotsu Akimoto.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 525-532, 1969. 8 p, 10 fig.

Descriptors: *Simulation analysis, *Floods, *Unsteady flow, Bores, Surges, Waves (Water), Digital computers, Mathematical models, Computer programs, Hydraulic models, Routing Channel morphology, Profiles, Stage-discharge relations, Flood routing.
Identifiers: Flood propagation.

Unsteady flow in river and channels may be analyzed by digital computer, taking account of various conditions of channel shape and flow. The method is based on the characteristics equations and combines the analysis of hydraulic bores and flow at varying sections in open channels. The simulation technique for calculation of flood propagation in a natural river is described, including methods of replacement of river shape, and the validity of this method is proved by comparison with results of experiments. (Knapp-USGS)
W71-01802

LAMINAR FLOW IN OPEN RECTANGULAR CHANNELS (A CONTRIBUTION TO THE FLOW PROBLEM OF OPEN CHANNELS),
H. Wagner.
Abstracts in French and German. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 43-51, 1969. 9 p, 5 fig.

Descriptors: *Open channel flow, *Laminar flow, *Equations, Mathematical studies, Streamflow, Stage-discharge relations, Velocity, Shear stress, Fluid friction.
Identifiers: Navier-Stokes equations.

Equations describing characteristics of laminar flow in open rectangular channels are based on the Navier-Stokes equations. For arbitrary width- to-depth ratios the exact function correlations of velocity distribution, flow, and shear stresses are developed. (Knapp-USGS)
W71-01803

SIMILITUDE OF MOBILE BED MODELS AND THE EFFECTS OF VARIATIONS ON THE LAWS OF SIMILITUDE (FRENCH),
Robert College, Istanbul (Turkey). Dept. of Hydraulics.
Fuat Senturk.
In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 321-335, 1969. 15 p, 3 fig, 4 ref.

Descriptors: *Hydraulic similitude, *Hydraulic models, Reynolds number, Froude number, Model studies, Sediment transport, Alluvial channels, Open channel flow.
Identifiers: Mobile bed models.

The problem of deviations from laws of similitude was studied. The deviation from Reynolds condition related to the grain size in the case of a river model causes a deviation from Froude's similitude also. (Knapp-USGS)
W71-01804

DETERMINATION OF COEFFICIENTS OF HYDRAULIC LOSS FOR UNSTEADY OPEN CHANNEL FLOW (FRENCH),
Technische Universitaet, Dresden (East Germany).
Marcel Bahler.
In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 181-188, 1969. 9 p, 2 fig, 2 tab.

Descriptors: *Unsteady flow, *Open channel flow, Mathematical studies, Equations, Head loss, Stage-discharge relations, Dam failure, Floods, Flood forecasting, Waves (Water), Surges, Simulation analysis, Model studies, Hydraulic models, Bores.
Identifiers: Unsteady open-channel flow.

In general, coefficients of hydraulic losses based on steady flow are used in the calculation of unsteady flow in open channels. This, theoretically as well as in practice, results in errors. In this paper a method is described for the determination of the coefficients of unsteady flow. Experiments which simulate the sudden and complete break of dams confirm the theoretical assumptions. (Knapp-USGS)
W71-01805

SIMULATION OF THE BAVARIAN REACH OF THE DANUBE RIVER,
Technische Hochschule, Munich (West Germany).
Wolfram Bauch.
French summary. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 385-394, 1969. 10 p, 4 fig, 1 ref.

Descriptors: *Simulation analysis, *Mathematical models, *Flood routing, Streamflow forecasting, Water levels, Floods, Water management (Applied), River training, Navigation, Flood control.
Identifiers: Danube River.

The training works of the Bavarian part of the Danube River are planned to obtain better conditions for navigation. The necessary width and depth of the channel can only be achieved by means of banking. The result is an acceleration of the movement of flood waves. In order to know in advance the flood-conditions due to the training works, a mathematical model is used which simulates flood-wave-propagation. An example for application of the mathematical model is given in a 60 km reach of the river for the 1954 flood. (Knapp-USGS)
W71-01806

DAMPED COOSCILLATING TIDE WITH NEGATIVE REFLECTION AT THE END OF THE ESTUARY,
Ecole Polytechnique, Montreal (Quebec).
For primary bibliographic entry see Field 02L.
W71-01808

LABORATORY INVESTIGATION OF THE TURBULENT DIFFUSION IN OPEN CHANNEL BY MEANS OF SALT WATER INJECTION,
Seoul National Univ. (Republic of Korea). Dept. of Civil Engineering.
For primary bibliographic entry see Field 05B.
W71-01809

ON VERTICAL SALINITY DISPERSION INTO FRESH WATER OVER SALT WATER DUE TO TURBULENCE,
Kyoto Univ. (Japan). Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 02L.
W71-01810

MATHEMATICAL MODEL OF THE RECOVERY OF SALINITY STRATIFICATION IN THE UNSTEADY FLOW REGIME (FRENCH),
Electricite de France, Paris.
For primary bibliographic entry see Field 02L.
W71-01812

THE MECHANICS OF SUSPENDED SEDIMENT DUE TO WAVE ACTION,
Chuo Univ., Tokyo (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02J.
W71-01814

SUBCRITICAL FLOW AT OPEN CHANNEL STRUCTURES - OPEN CHANNEL EXPANSIONS,
Utah Water Research Lab., Logan.
Lloyd H. Austin, Gaylord V. Skogerboe, and Ray S. Bennett.
Available from the NTIS as PB-195 928, $3.00 in paper copy, $0.95 in microfiche. Utah Water Research Laboratory Report PRWG71-1, August 1970. 78 p, 51 fig, 7 tab, 24 ref, append. OWRR Project No B-018-UTAH (1).

Descriptors: *Open channel flow, *Subcritical flow, *Model studies, *Channel morphology, *Ex-

pansion, Mathematical studies, Equations, Flow characteristics, Head loss, Flow rates, Velocity, Flow profiles.
Identifiers: *Specific energy.

Analyzing the hydraulics of open channel constrictions has been modified to allow the analysis of energy loss in open channel expansions. The modified subcritical flow technique has been compared with previous methods of analysis using data collected in the laboratory on open channel expansions with vertical walls, and triangular-shaped baffles. Also, a design procedure for such baffled outlet structures has been developed. The expansion ratio has a significant influence upon the hydraulic characteristics of open channel expansions. As the expansion ratio is increased, the degree of nonuniformity of velocity distributions in the expansion structure will increase with consequent increases in energy loss. Any flow instability at the inlet will become more aggravated as the flow moves through the expansion. Thus, the flow at the outlet will be improved if uniform flow with uniform velocity distribution occurs at the inlet. Although such ideal flow conditions cannot usually be expected under field conditions, they can serve as a goal for the hydraulic engineer. (Woodard-USGS)
W71-01836

EXPERIMENTAL STUDIES OF FLOWS WITH HIGH SOLID PARTICLE CONCENTRATIONS,
M. V. Pechenkin.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2 (Subject B), Science Council of Japan, Kyoto, p 157-164, 1969. 8 p, 4 fig, 1 tab, 9 ref.

Descriptors: *Sediment transport, *Pipe flow, *Design flow, Mathematical studies, Equations, Closed conduit flow, Turbulent flow, Pipelines, Sediment distribution, Hydraulics, Kinetics, Suspended load, Particle size, Flow rates, Foreign projects.
Identifiers: *Leningrad (USSR).

Experimental studies by the Laboratory of Hydraulic Transport of Solids in Leningrad, U.S.S.R., on the turbulence characteristics in pipe flows with high sediment concentrations resulted in establishing the relationship between the distribution of suspended particle concentrations and vertical fluctuating velocity components. Experimental studies of flows with high concentrations established the influence of particle concentration on the fluctuation characteristics of the fluid motion. Integration of the continuity equation for the solid phase of the suspension flow incorporating experimental relationships led to a calculation formula for sediment distribution over the depth of a horizontal flow. The formula is valid for the whole range of concentration values from zero to maximum value. (Woodard-USGS)
W71-01920

UNIFORM TURBIDITY CURRENT EXPERIMENTS,
Norges Tekniske Hoegskole, Trondheim. River and Harbor Lab.
Einar Tesaker.
French summary. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2 (Subject B), Science Council of Japan, Kyoto, p 1-8, 1969. 8 p, 6 fig, 1 tab, 4 ref.

Descriptors: *Turbidity currents, *Test procedures, *Hydraulic models, *Mathematical studies, Flumes, Clays, Slurries, Sands, Flow, Velocity, Density, Slopes, Discharge (Water), Sediments, Interfaces, Turbidity, Equations, Foreign projects.

An experimental study of continuous turbidity currents was made in a 10 m long tank with a submerged, tiltable flume. Clay slurries with varying amounts of fine sand were discharged continuously during two minute periods into the upper part of the flume. Apparently uniform turbidity currents with well defined interface were created. Velocity and density distributions were measured in sections normal to the flow. Characteristic parameters include slope, discharge, and sediments. Nearly linear density distributions were found in many of the runs. Maximum velocities occurred in the lower third of the currents. Data for the bed and interface shear and the apparent eddy viscosity were caluclated. A discussion of some of the results, and comments to the application of existing 'stability' criteria to turbidity currents are included. (Woodard-USGS)
W71-01922

MECHANICS OF TURBULENT FLOW IN SEDIMENT-LADEN STREAMS,
Universidad Central de Venezuela, Caracas. Dept. of Engineering.
For primary bibliographic entry see Field 02J.
W71-01923

TRANSPORT CAPACITY OF TURBULENT TWO-PHASE FLOW,
Institut za Vodoprivredu Jaroslav Cerni, Belgrade (Yugoslavia).
For primary bibliographic entry see Field 02J.
W71-01925

A STUDY OF THE AIR-WATER INTERFACE IN AIR-ENTRAINED FLOW IN OPEN CHANNELS,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
John M. Killen, and Alvin G. Anderson.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2 (Subject B), Science Council of Japan, Kyoto, p 339-347, 1969. 9 p, 4 fig, 10 ref.

Descriptors: *Air-water interfaces, *Air entrainment, *Flow, *Open channels, Boundaries (Surfaces), Methodology, Electrodialysis, Flow characteristics, Electrodes, Channel morphology, Diffusion, Equilibrium, Turbulence, Equations.
Identifiers: *Analytical expression.

Experimental evidence indicates that the upper boundary of an air-entrained flow is a connected wavy surface rather than a cloud of discrete water droplets. Air is drawn through the rough surface by a process of overturning waves and surface rollers. This entrained air is carried downward by turbulent diffusion against the buoyant forces until an equilibrium is reached giving a stable air concentration distribution. The interface between air and water remains intact and very rough over a great range of flow conditions. The surface waves or irregularities are of random amplitude and of the same order as the total depth of flow. The statistical properties of the interface measured by an electrical probe are described by an analytical expression and related to average air concentrations. (Woodard-USGS)
W71-01926

REPRESENTATION OF NON-GRANULAR BOUNDARIES IN HYDRAULIC MODELS,
Department of State Hydraulic Works, Ankara (Turkey). Research Section.
Yuksel Sayman.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2 (Subject B), Science Council of Japan, Kyoto, p 131-138, 1969. 8 p, 4 photo.

Descriptors: *Sediment transport, *Model studies, *Hydraulic models, *Structure, *Construction materials, *Bentonite, Boundaries (Surfaces), Design, Flow, Spillways, Sediment discharge, Research and development, Foreign projects.
Identifiers: *Ankara (Turkey).

The attributes of bentonite as a material for hydraulic-model boundaries in sediment transport studies is discussed from tests made in the Research Department of the State Hydraulic Laboratories in Ankara, Turkey. Bentonite, a clay substance, can be applied to represent a concrete mass or a rocky block in river beds or rocky bank slopes of river channels and is more suitable than using noncohesive granular materials in large models. By using bentonite, a researcher has an advantage of realizing his ideas on the model in a very short time. He can improve a lot of new variants during a test by breaking off the water of the model for short periods and making necessary troweling, etc., on the bentonite bodies. Examples of applicaton and effects of bentonite in hydraulic models are presented. (Woodard-USGS)
W71-01927

POLYPHASE CURRENTS WITH NONUNIFORM SEDIMENTS AND THE PHYSICS OF RIVER FLOW,
For primary bibliographic entry see Field 02J.
W71-01929

THE EFFECT OF BED FORMS ON THE HYDRAULIC RESISTANCE,
Middle East Technical Univ., Ankara (Turkey). Dept. of Civil Engineering and Lehigh Univ., Bethlehem, Pa. Fritz Engineering Lab.
R. Acaroglu, and Walter H. Graf.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2 (Subject B), Science Council of Japan, Kyoto, p 199-202, 1969. 4 p, 2 fig, 5 ref.

Descriptors: *Sediment transport, *Beds under water, *Open channels, *Closed conduit flow, Slopes, Flow rates, Velocity, Dynamics, Turbulent flow, Resistance, Boundaries (Surfaces), Sediment distribution, Hydraulics, Sediments, Particle size.
Identifiers: *Bed forms, *Hydraulic resistance.

Depending on the kind of conveyance system, the determination of the kinds of sediment transport and the related bed forms may serve different purposes. This paper presents two graphs as follows: Figure 1, Typical slope and velocity relationship for free surface flows; Figure 2, Typical slope and velocity relationship for closed conduits. The striking similarities between the slope and mean flow velocity relationships shown in Figures 1 and 2 give valuable support to the existence of a close interrelation between the mechanisms of the two different sediment transport phenomena. (Woodard-USGS)
W71-01931

DISTRIBUTION OF SUSPENDED MATTER AND SIMILARITY CRITERIA IN SETTLING BASINS,
Technical Univ. of Istanbul (Turkey). Dept. of Hydraulic and Water Power.
Kazim Cecen, Mehmetcik Bayazit, and Mutlu Sumer.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 215-225, 1969. 11 p, 5 fig, 6 ref.

Descriptors: *Sedimentation, *Hydraulic similitude, *Hydraulic models, Mathematical models, Diffusion, Turbulence, Dimensional analysis, Settling velocity, Froude number, *Settling basins.
Identifiers: *Sedimentation models.

A mathematical model was established for the settling of suspended grains in a turbulent flow using the law of conservation of matter and employing the assumptions made by Taylor and Elder for turbulent diffusion. The solution of this equation gives an expression for the suspension concentration in a settling basin. This expression is used to determine

the similarity criteria for settling basins. The distribution of concentration is found to depend on three nondimensional variables. Models of settling basins must have Froude similarity, and the settling velocity of the grains must be scaled in the same way as the flow velocity. (Knapp-USGS)
W71-01937

THE TURBULENCE WITH FINE PARTICLES IN UPWARD FLOW,
Kyushu Univ., Fukuoka (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02J.
W71-01938

ON THE MECHANICS OF SALTATION OF A SPHERICAL SAND PARTICLE IN A TURBULENT STREAM,
Kyoto Univ. (Japan). Disasters Prevention Research Inst.
For primary bibliographic entry see Field 02J.
W71-01939

SOME DYNAMIC PROBLEMS OF THE MECHANICS,
V. M. Ljatkher, and B. I. Didoukh.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 85-93, 1969. 9 p, 1 fig, 5 ref.

Descriptors: *Unsteady flow, *Flow, *Porous media, *Fluid mechanics, Seepage, Stress, Tailwater, Earthquakes, Dam failure, Drainage systems, Soil mechanics.
Identifiers: Multiphase porous media.

The basic concepts of the mechanics of two- or three-phase porous medium subjected to dynamic effects are developed, the system of equations is given, and the basic one-dimensional boundary problems considering the interaction between the 'skeleton' of the pore medium and the fluid in the pores are formulated and solved. The statement and the results of the boundary problems solution can be used for calculation of vibrations of protection slabs in the tailwater of hydraulic structures, solving for pressure pulsations in drainage systems, evaluation of the conditions initiating debris flow, and for calculation of the earth dam deformations caused by earthquakes. (Knapp-USGS)
W71-01946

RELATIONSHIP BETWEEN VELOCITY OF SEEPAGE AND HYDRAULIC GRADIENT IN THE ZONE OF HIGH VELOCITY,
Research Inst. for Water Resources Development, Budapest (Hungary).
Gyorgy Kovacs.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 25-38, 1969. 14 p, 5 fig, 2 tab, 11 ref.

Descriptors: *Darcys law, *Groundwater movement, Particle size, Particle shape, Porosity, Permeability, Hydraulic conductivity, Hydraulic models, Model studies, Viscosity, Mathematical studies, Froude number, Turbulent flow.
Identifiers: *High-velocity groundwater flow.

The general validity of Darcy's law is discussed; the best formula for calculating Darcy's hydraulic conductivity is the Kozeny-Carman equation. About 300 data from 14 experimental series executed in 4 different laboratories were used for the investigation of homodisperse samples of spheres. Equations of movement characterizing different types of seepage are derived as a function of Reynold's number. The differences are caused by the grains contacting each other not only at a single point, but on various surfaces. Thus the total active surface of grains is smaller than that taken into account for determination of the shape coefficient, and, therefore the samples represent another shape coefficient which differs from the calculated one. (Knapp-USGS)
W71-01947

THE LINEAR AND NON-LINEAR REGIMES OF THE FILTRATION LAW AND THEIR CONSEQUENCES IN GEOHYDRAULIC PROBLEMS,
Hydraulic Research Inst., Prague (Czechoslovakia).
For primary bibliographic entry see Field 02F.
W71-01948

FLOW OF IMMISCIBLE FLUIDS IN UNCONFINED AQUIFERS,
For primary bibliographic entry see Field 02F.
W71-01951

RESEARCH OF THE SOLID-LIQUID FLOWS WITH HIGH CONSISTENCE,
Akademiya Nauk URSR, Kiev.
N. A. Silin, Yu. K. Vitoshkin, V. M. Karasik, and V. F. Ocheretko.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2, (Subject B), Science Council of Japan, Kyoto, p 147-156, 1969. 10 p, 4 fig, 2 ref.

Descriptors: *Sediment transport, *Pipe flow, *Model studies, Fluid mechanics, Sediments, Pipelines, Dynamics, Turbulent flow, Sediment distribution, Particle size, Flow rates, Mathematical studies, Equations, Foreign projects.
Identifiers: *USSR.

Two methods for studying flow characteristics of solids with fluids in pipelines are presented. The first is based on the measurements of the instantaneous velocities and the liquid-solid component consistence in an arbitrary flow point by means of photographs and motion pictures. The second method is based on the hydrodynamic tube measurements of the average longitudinal velocity of a small volume mixture in arbitrary part of two-phase flow. Comparison of the results showed a possibility of an application of the hydrodynamical tubes for the measurements in the two-phase flows. (Woodard-USGS)
W71-01952

THE STRUCTURE OF NATURAL TURBULENT SEDIMENT-LOADED STREAMFLOW,
Gidrometeorologicheskii Institut, Odessa (USSR).
For primary bibliographic entry see Field 02J.
W71-01955

THE CHARACTERISTICS OF FLOW WITH WASH LOAD,
Tokyo Inst. of Tech. (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02J.
W71-01957

THE ANALYSIS OF THE FLOW OF LAYERED FLUIDS,
New South Wales Univ., Kensington, (Australia). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02L.
W71-01959

INVESTIGATION OF AXISYMMETRICAL STRATIFIED FLOW TOWARDS A POINT SINK,
Tokyo Inst. of Tech. (Japan); and Japan Atomic Power Co., Tokyo. Civil Engineering Section.
For primary bibliographic entry see Field 05G.
W71-01960

EFFLUENT FROM A SLOT INTO STAGNANT OR MOVING AMBIENT FLUID OF GREATER DENSITY,
Hydraulics Research Station, Wallingford (England).
For primary bibliographic entry see Field 05G.
W71-01961

THEORETICAL DESCRIPTION OF FREE SURFACE TWO-PHASE FLOW OVER A WAVY BED,
Universidad Central de Venezuela, Caracas. Hydraulics Lab.
Marco Falcon.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2, (Subject B), Science Council of Japan, Kyoto, p 139-146, 1969. 8 p, 8 ref.

Descriptors: *Sediment transport, *Theoretical analysis, *Free surfaces, *Flow, *Streambeds, Model studies, Channel morphology, Channel flow, Mathematical studies, Equations, Analytical techniques, Sediment load, Suspensions, Particle size, Bed load, Turbulent flow, Flow rates, Flow resistance, Fluid mechanics.
Identifiers: *Wavy channel bed, Erodible bed, Two-dimensional diffusion equation, Caracas (Venezuela).

In Caracas, Venezuela, an analytic model of free surface flow carrying suspended sediment over an erodible bed together with a two-dimensional sediment diffusion equation was used to study the interaction of the sediment and fluid phases. The free surface flow model is based on the potential flow over a two-dimensional, slowly moving, wavy bed with a sinusoidal profile of varying amplitude. The effect of the bed forms on the concentration of sediment within the flow is found and used to obtain the sediment transport rate and the phase shift between it and the bed form profile. Expressions are also found for the rate of amplitude growth and rate of longitudinal displacement of the bed forms. (Woodard-USGS)
W71-01962

A THEORY OF TURBULENCE IN STRATIFIED FLUIDS,
Johns Hopkins Univ., Baltimore, Md. Dept. of Mechanics.
Robert R. Long.
Journal of Fluid Mechanics, Vol 42, Part 2, p 349-365, June 1970. 21 ref.

Descriptors: *Stratified flow, *Turbulence, *Density stratification, Fluid mechanics.
Identifiers: *Richardson number, *Density gradient.

The theoretical analysis of an idealized experiment in which turbulence of a patchy nature is precurred to exist in regions of large Richardson numbers, is presented in this paper. The theory for turbulent flow over a flat plate which is moved and cooled in such a way as to produce constant vertical fluxes of momentum and heat is developed. It is indicated that in a coordinate system fixed in the plate the mean velocity increases linearly with height z above a turbulent boundary layer and the mean density decreases as Z cu, so that the Richardson number is large far from the plate. For this theory the curvature of the density profile states that when the curvature is negative a volume of fluid, thoroughly mixed by turbulence, will tend to flatten out, at a new level well above the original center of mass, thereby transporting heat downward. When the curvature is positive a mixed volume of fluid will tend to fall a similar distance, again transporting heat downward. The relationship between the curvature of the density profile and the transfer of heat suggests that the density gradient near the level of a point of inflection of the density curve will increase locally as time goes on. It is concluded that in natural circumstances, it appears that layers of strong shear and density gradient will tend to

form wherever the curvature of the density profile changes sign. (Herrera-Vanderbilt)
W71-02056

STATISTICAL PROPERTIES OF TURBULENT DENSITY FLUCTUATIONS,
IIT Research Inst., Chicago, Ill.
L. N. Wilson, and R. J. Damkevala.
Journal of Fluid Mechanics, Vol 43, Part 2, p 291-303, August 1970. 10 fig, 7 ref.

Descriptors: *Turbulent flow, *Mass-density fluctuations, *Refractive index, *Density gradient.
Identifiers: *Crossed-beam technique, *Schlieren instrument, *Density fluctuations.

This paper presents the study of the local refractive index fluctuations from which mass-density fluctuations can be inferred directly, both being local properties of a fluid, by employing the crossed-beam correlation technique. The refractive index changes are monitored by using the crossed-beam as a Schlieren instrument, the signals obtained then being a measure of refractive index gradients. Since crossed-beam geometry results in an over integral in the cross-flow direction, these gradients tend to be integrated out and no independent scale-length estimates are then required. Some analysis and experimental results concerning the crossed-beam Schlieren instrument and a description of it is presented. It is established that density fluctuations are related isentropically to the pressure fluctuations, which in turn are driven by inertial fluctuations. A conclusion is that optical cross-correlation techniques can be used with Schlieren instruments to obtain density fluctuation statistics in turbulent flows. (Herrera-Vanderbilt)
W71-02057

LOW-FREQUENCY MODULATION OF THERMAL INSTABILITY,
Imperial Coll. of Science and Technology, London (England). Dept. of Mathematics.
S. Rosenblat, and D. M. Herbert.
Journal of Fluid Mechanics, Vol 43, Part 2, p 385-398, August 28, 1970. 5 fig, 7 ref.

Descriptors: *Temperature gradient, *Buoyancy force, *Flow boundaries.
Identifiers: *Thermal instability, *Temperature fluctuations, *Rayleigh number, Boussinesq equation, *Disturbances in flow.

According to Venezian's paper, an incompressible viscous fluid is confined between parallel horizontal planes, and is of infinite horizontal extent. An equilibrium state is maintained under the action of a vertical temperature gradient, which combines a uniform component together with a component varying sinusoidally in time. It is found that this equilibrium is unstable to small disturbances at certain values of the relevant parameters. A solution is obtained by an approximation method based on the smallness of the amplitude ratio in order to determine the modulating effect of the oscillation on the stability characteristics of the mean gradient. It is concluded that for a certain class of disturbances, those of which linearization is valid and whose initial values are independent of frequency, the periodicity criterion is a sufficient condition for instability. (Herrera-Vanderbilt)
W71-02059

MASS OF HEAT TRANSFER FROM A SOLID BOUNDARY TO A TURBULENT FLUID,
Institut Politehnic Bucuresti (Rumania).
E. Ruckenstein.
Int. Journal of Heat and Mass Transfer, Vol 13, p 1283-1291, Pergamon Press. 10 ref.

Descriptors: *Mass transfer, *Heat transfer, Turbulence, Boundary processes, Turbulent flow, Laminar flow, Temperature, Energy equation, Momentum equation, Diffusion, Reynolds number.
Identifiers: Turbulent heat, Prandtl's equation.

The problem of turbulent heat or mass transfer from a solid boundary is treated by dividing the turbulent flow into two regions. For the region in the immediate vicinity of the wall one uses a physical model proposed previously by the author. In the model one considers the turbulent motion as a succession along the wall of quasi-steady laminar motions each of them having a short path. Compared to the preceding treatment, in the present one takes into account various forms of dependence of the shear stress on the distance y to the wall. For a constant shear stress the case of the turbulent motion in a pipe is obtained, while for a shear stress proportional to y that of turbulent separated flows near the separation point. For the fully turbulent region, Prandtl's equation for the turbulent kinetic energy is used and on its basis one obtains an equation for the turbulent diffusion coefficient and for the mass transfer flux. The equation for the turbulent kinetic energy has allowed to propose a procedure for obtaining information concerning the length x sub o of the laminar path. The form of dependence of the shear stress on the distance from the wall has a great influence on the manner in which the mass transfer coefficient depends on the diffusion coefficient, viscosity and fluid viscosity. (Novotny-Vanderbilt)
W71-02060

THE STABILITY OF STRATIFIED SHEAR FLOWS,
Essex Univ., Colchester (England). Dept. of Mathematics.
M. R. Collyer.
Journal of Fluid Mechanics, Vol 42, Part 2, p 367-377, June 22, 1970. 4 fig, 1 tab, 7 ref.

Descriptors: *Stratified flow, *Shear flow, *Stability, *Jet flow, *Density stratification, Fluid mechanics.
Identifiers: *Richardson number, *Wave equation, *Neutral curve.

In this paper, the study of small perturbations of a parallel shear flow U (z) in an inviscid, incompressible stably stratified fluid of rho (z), for which the principal measure of stability is the Richardson number R, is being presented. A discussion for an arbitrary velocity and density profile is presented, to determine whether a curve of neutral stability has adjacent unstable regions in an (alpha, R) plane, where alpha is the wave number of disturbance. Neutral curves bounding unstable regions are then obtained for a triangular jet flow in conjunction with various density distributions. A comparison is also made between the stability characteristic of jet and shear flows with corresponding density structures and is concluded that the possibility of no unstable waves develop for certain values of N in the uppermost layer appears to be its principal distinction. It is also concluded that: It's evident for any combination of velocity and density profiles studied, the flow is unstable if R A1/4 at any level, unless the unstable wavelengths cannot be excited due to restrictions imposed by the boundary conditions. (Herrera-Vanderbilt)
W71-02061

CHANNEL FLOW INDUCED BY A TRAVELLING THERMAL WAVE,
Colorado Univ., Boulder. Dept. of Aerospace Engineering Sciences.
Chuen-Yen Chow.
Journal of Fluid Mechanics, Vol 43, Part 2, p 419-429, August 1970. 7 fig, 7 ref.

Descriptors: *Thermal conductivity, *Fluid velocity, Channel flow, Fluid motion, Reynolds number.
Identifiers: *Traveling thermal wave, *Induced motion, *Prandtl number, *Thermal boundary conditions.

According to Davey's analysis the results were presented only for the limiting cases in which the frequency of flame rotation was either very low or very high. The purpose of this work is to fill in this gap, within which the fluid speed is much greater and reaches a maximum, and to show the change in mean velocity profile as the frequency increases. The effect of thermal boundary conditions of the flow and shear stress is also analyzed. It was found in previous analysis that the induced fluid motion does not exert a net shear force on either plate when the fluid is bounded by two parallel plates. It is shown in this paper that this is the result of the assured thermal boundary conditions. An analysis is carried out linearized under the assumption that the induced motion is slower than the speed of the heat source. Experiments showed that a mean fluid motion can be induced in a channel by a traveling thermal wave, this mean motion being always in a direction opposite to that of the thermal wave. An analysis is presented to indicate that the induced mean motion is always in a direction opposite to that of the thermal wave and its magnitude increases rapidly with decreasing Prandtl number is zero. (Herrera-Vanderbilt)
W71-02067

DISCUSSION OF DISPERSIVITY TENSOR FOR TURBULENT UNIFORM CHANNEL FLOW,
California Univ., Berkeley.
Hugo B. Fischer.
In: Proceedings, American Society of Civil Engineers, Journal of Hydraulics Division, p 1096-1100, April 1970. 2 fig, 1 tab, 3 ref.

Descriptors: *Channel flow, *Turbulent flow, *Uniform flow, *Diffusion, *Dispersion, Eddies, Turbulence.
Identifiers: *Fickian transport coefficient.

This paper presents a discussion of the work presented by Gedeon Dagan in September, 1969, where the author points out that turbulent mixing coefficient may be considered to be a second order tensor. It is said that neither form can provide an exact representation of the diffusive effects of turbulence, but that in many cases the nature of the physical process is such that the averaged scaler representation is at least as correct as, and sometimes, more correct than, the tensor. It is also discussed that according to the author's conclusion, in three dimensional turbulent flow, the isovels represent a principal axis for a mixing tensor for both mass and momentum. The writer of this discussion does not agree, because whereas the local orientation of the isovels does not reflect the concentration distribution at some distance from a point, the concentration distribution at some distance does affect the local mass transport. Examples and analysis of these discussions are presented. (Herrero-Vanderbilt)
W71-02068

SYSTEM SIMULATION FOR ANALYSIS AND DESIGN,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
For primary bibliographic entry see Field 06A.
W71-02082

8C. Hydraulic Machinery

COMPUTER CONTROLS AND MEASUREMENTS: WALTZ MILL 1100 KV UNDERGROUND TRANSMISSION TEST FACILITY,
Westinghouse Electric Corp., East Pittsburgh, Pa.
F. S. Young.
Trans Pap 70 TP 558 - PWR, Inst Elec Electron Eng Summer Power Meet and EHV Conf, Los Angeles, Calif, July 1970. 10 p, 9 fig, 11 ref.

Descriptors: Transmission (Electrical), *Electric cables, *Extra high voltage, Computers, *Test facilities, *Control systems, Measurement, *Instrumentation, Test procedures, Testing, Process control, Computer programs, Temperature.
Identifiers: *High voltage, *Underground cables, Waltz Mill Project (Pa), Underground transmission lines, Electric conductors.

The Waltz Mill Project in Pennsylvania is a research center devoted to performing accelerated life testing of underground transmission systems. Prototype samples can be tested at voltages ranging from 115 to 1100 kv. The control systems, instrumentation circuits, and computer programs available at the facility for cable testing are described. If feasible, when prototypes of resistive cryogenic, super-conducting, gas insulated, extruded dielectric, and other underground transmission systems rated in voltages from 115 kv to 750 kv become available, sample sections may be installed and tested at the Waltz Mill Underground Transmission Test Facility. (USBR)
W71-01728

TECHNIQUES TO EVALUATE THE TRANSIENT PERFORMANCE OF CABLES AND JOINTS,
Southampton Univ. (England); and Central Electricity Generating Board, Leatherhead (England). Central Electricity Research Labs.
B. M. Weedy, and M. J. Thelwell.
Conf Pap 70 CP 530 - PWR, Inst Elec Electron Eng Summer Power Meet and EHV Conf, Los Angeles, Calif, July 1970. 10 p, 14 fig, 6 tab, 11 ref, 2 append.

Descriptors: Extra high voltage, *Electric cables, *Analogs, Heat flow, *Joints (Connections), Performance, Computers, Analysis, Transients, Thermal properties, Foreign research, Resistors, Capacitors, Cooling, Water cooling.
Identifiers: High voltage, *Temperature rise, Great Britain, Test results.

Computational methods used to evaluate the transient temperature rises in high-voltage cables and joints caused by operational changes occurring in the system are reviewed. The development and use of resistance-capacitance network analogs to solve the 2- and 3-dimensional heat flow problems in cables and joints, respectively, are described. Limitations of the calculation methods and the use of computer solutions are discussed, and results are given. (USBR)
W71-01729

THE NUKES ARE COMING.

Quest, Vol 8, No 2, p 2-21, Apr 1970. 20 p, 12 fig, 1 tab.

Descriptors: Electric powerplants, *Electric power production, Coals, *Nuclear powerplants, *Hydroelectric power, Planning, Safety, Cooling water, Nuclear wastes, Inter-basin transfers, Scheduling, Construction, Transmission lines, Locations, Thermal pollution, Radiation hazards, Cooling towers.
Identifiers: *Nuclear power, *Hydroelectric resources, Nuclear fuels, Pacific Northwest-Southwest Intertie, Nuclear radiation, Fossil fuels.

The Pacific Northwest is about to begin a new era of electric power production. Hydroelectric expansion is nearly at an end, with only a few sites remaining that meet the requirements for a hydro dam. Sites meeting the physical criteria for hydro dam installations are subject to controversy among power-producing agencies, conservationist organizations, and sportsmen groups. Regional power deficits predicted for as early as 1973-74 are alarming. Coal-fired and nuclear-fueled powerplants and attendant problems are discussed. Radioisotope leakage, natural radiation levels, somatic and genetic hazards of radiation, reactor safeguards, and problems of storing spent uranium fuel are reviewed. With the ever-increasing demand for electric energy, nuclear power appears to be the coming source in the Pacific Northwest. (USBR)
W71-01730

PRESTRESSED ROCK ANCHORS AND SHOTCRETE FOR LARGE UNDERGROUND POWERHOUSE,
M. Buro.
Civ Eng, Vol 40, No 5, p 60-64, May 1970. 5 p, 4 fig, 2 photo, 5 ref.

Descriptors: *Prestressing, *Underground powerplants, *Rock bolts, *Tunnel linings, *Anchors, Soil stabilization, Pumped storage, Costs, Construction, Foreign construction, Extensometers, Overbreak, Safety, Rock excavation, Grouting, Instrumentation, Rock mechanics, *Gunite, Underground structures, Post tensioning.
Identifiers: Switzerland, *Shotcrete, Underground cavities, *Hongrin Power plant, Switzerland, Tunnel supports, Anchor cables.

The Hongrin underground pumped storage station in Switzerland used prestressed rock anchors and shotcrete lining in the underground powerplant, 450 by 100 ft in plan and with arched ceiling 90 ft high, a total excavated volume of 2.9 million cu ft. Stabilization with prestressed rock anchors is distinguished from the more conventional lining methods by the fact that prestressing creates an active arch in the rock, making it act as its own structural support. Such a structure adapts to rock deformation until the whole mass stabilized completely. Excavation began in small longitudinal galleries following the contour of the arched ceiling; the galleries were made large enough to permit drilling and installing rock anchors, but small enough to minimize scaffolding and bracing. Other advantages of the excavation technique include less rock overbreak, lower labor costs, and improved crew safety. Details of the prestressed rock anchors and the 10-step procedure used in constructing the powerplant are described. (USBR)
W71-01735

COLLECTION OF RECENT USSR NEWSPAPER ARTICLES ON POWER GENERATION AND TRANSMISSION IN THE SOVIET UNION.

USR Power Generation and Transmission, Transl from Russ, Bur Reclam Transl 716, July 1970. 132 p, 26 fig, 6 map.

Descriptors: *Reviews, Foreign construction, Extra high voltage, Extra long distance, *Transmission (Electrical), Electric power, *Power system operations, *Electric power production, Electric powerplants, Electric power costs, Multiple-purpose projects, Project planning, Geography, Powerhouses.
Identifiers: USSR, *Power grids, Power interchange, Interties, International cooperation.

A collection of recent Soviet newspaper articles on the electric power generation and transmission aspects of the efforts of the USSR to meet energy needs is presented. The articles have been translated, and in the case of longer articles of marginal interest, have been abstracted to review Soviet accomplishments of the last decade and plans for the future. The result is a general picture of a huge country with difficult geography trying to stretch the energy ruble to include thermal, hydraulic, tidal, geothermal, and nuclear powerplants, and to transmit the energy produced over long transmission lines across plains, mountains, deserts, taiga forest, and permafrost tundra. Unification of sectional power systems by ehv interties into the United Power System of European Russia was achieved during the last decade; gradual extension to the whole country is the goal for the seventies. Providing power from the energy-rich areas of Siberia to European Russia with enough surplus to export to the Comecon countries via the Mir 400-kv line is a constant problem because the demand for electrical energy and the population are growing not only in the western highly industrialized areas but also in the developing Siberian and Central Asian regions. (USBR)
W71-01742

GRAND COULEE 230- AND 115-KV PIPE-TYPE CABLE SYSTEMS,
Bureau of Reclamation, Denver, Colo.
J. J. Ray, and R. J. Mueller.
Conf Pap No 70 CP 559 - PWR, Inst Elec Electron Eng Summer Power Meet and EHV Conf, Los Angeles, Calif, July 1970. 7 p, 10 fig, 3 ref.

Descriptors: *Electric cables, *Installation, Coolants, Temperature, Aesthetics, Electric power, *Transmission (Electrical), High pressure, Field tests, Costs, Electric insulation, Electrical equipment, Design.
Identifiers: *Pipe-type cables, *Cooling systems, *Insulating oil, *High voltage, Cable terminations, Grand Coulee Powerplant, Wash.

Modification work to existing Grand Coulee electrical facilities consists of six 230-kv and two 115-kv pipe-type cable circuits to serve as the transformer circuits between the powerplants and the 230-kv consolidated switchyard and 115-kv switchyard on the west bank. The circuits replace the original 19 overhead transformer circuits. Design and installation of the high-pressure oil, pipe-type cable systems for Grand Coulee Left and Right Powerplants required consideration of unusual parameters such as the 650 ft of elevation difference between terminals, restricted circuit routing, and variable ambient conditions. The resulting cable construction details, pothead configuration, oil circulation, and cable cooling systems are described. Critical time schedules for energization introduced factors into the installation work, which complicated an already difficult job. Innovative procedures and equipment are described and the effectiveness of skid wire design and cable pulling lubrication are analyzed. (USBR)
W71-01743

INVESTIGATION OF PERFORMANCE CHARACTERISTICS FOR SANITARY PLUMBING FIXTURES.
National Bureau of Standards, Washington, D.C. Building Research Div.
For primary bibliographic entry see Field 05D.
W71-02052

CHANGING EMPHASIS IN THE SITING OF STEAM ELECTRIC POWER STATIONS,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 05C.
W71-02063

8D. Soil Mechanics

EVALUATION OF SOILS AND PERMAFROST CONDITIONS IN THE TERRITORY OF ALASKA BY MEANS OF AERIAL PHOTOGRAPHS, VOLUME I,
Purdue Univ., Lafayette, Ind., Engineering Experiment Station.
For primary bibliographic entry see Field 02C.
W71-01665

EVALUATION OF SOILS AND PERMAFROST CONDITIONS IN THE TERRITORY OF ALASKA BY MEANS OF AERIAL PHOTOGRAPHS, VOLUME II.
Purdue Univ., Lafayette, Ind., Engineering Experiment Station.
For primary bibliographic entry see Field 02C.
W71-01666

PHENOMENON AND MECHANISM OF FROST HEAVING,
Cold Regions Research and Engineering Lab., Hanover, N.H.
C. W. Kaplar.
Highw Res Rec, No 304, p 1-13, 1970. 13 p, 13 fig, 1 tab, 22 ref.

Descriptors: *Frost heaving, *Frost action, Freezing, *Frozen soils, *Frozen ground, Soils, Laboratory tests, Soil structure, Soil pressure, *Heaving, Ice, Soil mechanics, Soil water, Highways, Bibliographies, Negative pressure, Soil water movement.

Identifiers: Liquid films, Ice lenses, Subpressure.

A mechanistic explanation of frost action in soils, based on the hypothesis that liquid films existing between particles and an ice lens are the focal centers of energy for the heaving process, is presented. An explanation of the development of suction forces in unfrozen liquid below the ice lens is presented, and experimental data are provided for closed and open systems. The effect of heat extraction and freezing penetration rates on rate of heaving is discussed. Laboratory data indicate 2 critical rates of freezing: (1) maximum heave rate, and (2) minimal heave rate equal to volume expansion of void water. The role of soil structure in frost susceptibility is discussed. Changes in frost heaving rates can be effected by the addition or removal of either or both coarse aggregate or soil fines. Suggestions are offered for approaches to soil modification to reduce heaving. (USBR)
W71-01726

LOW-TEMPERATURE EFFECTS ON THE COMPACTION AND STRENGTH OF A SANDY CLAY,
Purdue Univ., Lafayette, Ind.
W. H. Highter, A. G. Altschaeffl, and C. W. Lovell, Jr.
Highw Res Rec, No 304, p 45-51, 1970. 7 p, 4 fig, 2 tab, 17 ref.

Descriptors: *Cold weather construction, Earthworks, *Embankments, Soil mechanics, *Compaction, Soil strength, Clays, Statistical analysis, Dry weight, Compressive strength, Axial strain, Temperature, Laboratory tests, Construction, Compaction tests, Bibliographies, Soil structure, Pore water pressures.
Identifiers: Undrained shear strength.

With the feasibility of increased cold weather earthwork as a practical motivation, the compaction and strength characteristics of a sandy clay were studied in the laboratory over a temperature range of 35 to 85 deg F. The soil was compacted at 3 effort levels and at 4 water content levels for each effort level. The strength and stiffness of soil tested at one temperature but compacted at different temperatures increased with increasing compaction temperature. For soil compacted at the same temperature, the strength and stiffness increased with decreasing test temperature. Conclusions were (1) low temperature compaction reduces unit weight and as-compacted undrained strength; (2) compacted samples are stronger and stiffer when tested at low temperatures; (3) low temperature compaction effects can be compensated by increasing the compaction effort; (4) observed trends are probably seated in the factors of soil structure and pore water pressure; and (5) there seems to be no major deterrent to compaction of clayey soils in a cold, but unfrozen, condition. (USBR)
W71-01727

DESIGN AND PERFORMANCE OF PROVISIONS FOR FOUNDATION SEEPAGE CONTROL AT GARDINER DAM,
A. S. Ringheim.
Eng J, Can, Vol 53, No 4, p 17-25, Apr 1970. 9 p, 8 fig, 1 tab, 5 ref, disc.

Descriptors: Dams, *Dam foundations, Dam design, *Earth dams, Cutoff trenches, Seepage, Filters, Previous blankets, Drainage systems, Relief wells, Underseepage, Impervious blankets, Foreign construction, Foreign design practices, Performance, Underwater construction, Drains.

Gardiner Dam is a 210-ft-high, zoned earthfill embankment located in south-central Saskatchewan, Canada. Bedrock at the damsite is impervious Bearpaw Shale that outcrops near river level on both sides of the river. In the river channel, up to 110 ft of stratified pervious sand overlies bedrock. Right abutment overburden is dense, glacial till with layers and pockets of pervious materials. Overburden on the left abutment consists of up to 60 ft of interbedded sand, silt, and clay overlain by 40 to 50 ft of clean, free draining sand and gravel. Several alternatives for seepage control are discussed, including a positive cutoff trench to bedrock, steel sheet piling, and an impervious reservoir blanket. Seepage control measures adopted for the river channel section of the dam were: (1) a reservoir blanket covering the full width of the river and extending 1200 ft upstream from the dam, and (2) a filter blanket and pressure relief wells under the downstream toe of the dam. For the remaining portions of the dam, a positive cut-off trench was constructed to bedrock, and filter blankets and toe drains were constructed under the downstream embankment zones. Provisions for seepage under the spillway and locations and physical features of the entire seepage control system are presented. (USBR)
W71-01736

STABILIZATION OF HYDRAULIC BACKFILL WITH PORTLAND CEMENT: INCLUDING RESULTS WITH OTHER ADDITIVES,
Bureau of Mines, Spokane, Wash.
D. R. Corson.
Report No. RI 7327, Bur Mines, Jan 1970. 33 p, 20 fig, 9 tab, 18 ref.

Descriptors: Soil stabilization, Soil engineering, Soil mechanics, Soil strength, Soil cement, Soil tests, *Hydraulic fills, Effects, Earth materials, Backfill, *Portland cements, *Stabilization, Bibliographies, Compressive strength, Permeability, Admixtures, Regression analysis, Strength, Laboratory tests, Gradation, Cements, Density.
Identifiers: Compression tests, Triaxial tests, Permeability tests, Cement content.

Tests to determine the effect on the strength and permeability of hydraulic backfill by addition of varying amounts of Type I portland cement are described. Unconfined compression, triaxial compression, and permeability test data, and data from tests to determine effects of moist curing and fill densification on strength are given. Two strength prediction equations based on the physical and mineralogical properties of the materials were formulated. The equations accounted for 96 and 99% of the data variability, and yielded reasonable estimates of cemented strengths of materials having properties within the range of those used in the analysis. Gradation and cement content are the primary factors affecting sample strength; silica content is significant only in rich (5 to 1) sand-cement mixes. Triaxial tests showed higher strength for well-graded material and higher cohesion for fine material. Samples moist-cured in plastic bags had significantly lower strengths than comparable samples cured in room atmosphere. An increase in dry density of approximately 10 lb/cu ft resulted in 7-day strength increases of 25 to 67% Permeability decreased with increases in cement content and curing time. Has 18 references. (USBR)
W71-01740

STABILIZATION OF SHEAR-GENERATED SOIL AGGREGATES,
Minnesota Univ., Minneapolis. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 02G.
W71-01771

8E. Rock Mechanics and Geology

DISTRIBUTION OF STRESSES IN DISCONTINUOUS LAYERED SYSTEMS,
Coyne et Bellier, Paris (France).
V. Maury.
Water Power, Vol 22, No 5/6, p 195-202, May/June 1970. 8 p, 10 fig, 1 tab, 10 ref.

Descriptors: *Stress distribution, Stress analysis, Discontinuities, *Rock foundations, *Rock mechanics, Dam foundations, Deformation, Model studies, Stability, Theoretical analysis, Photoelasticity, Model tests, Interferometers, Models, Research and development, Friction, Foreign research.
Identifiers: Rock interfaces, Photoelastic interferometer, Comparative studies, France, Photoelastic model material.

Because of the complexity of determining stress patterns in rock foundations, deformation and stability of rock foundations for dams are based on approximate assumptions. Rock is assumed to be a continuum even though the fundamental characteristic of rock is that of discontinuity. A research program to investigate the stress distribution in discontinuous systems under applied loads is described. A theoretical method of analysis suitable for calculating stresses in stratified systems for cases of perfect bonding or perfect sliding between layers is presented. The method cannot be used for cases of friction between layers. Tests of photoelastic and interferometric models were used to check the theoretical analysis and to investigate the effect of different degrees of friction between layers. Assumptions used in the theoretical analysis that need refinement to reflect accurately the state of stress can be identified by comparing theoretical and experimental results. Then the model can be used to examine the change in mode of reaction when there is friction between layers. (USBR)
W71-01721

FAST-RESPONSE EQUIPMENT FOR ACOUSTIC LOGGING,
V. G. Gratinskii.
Phys Solid Earth, No 12, p 768-774, Dec 1969. 7 p, 6 fig, 15 ref.

Descriptors: *Borehole geophysics, Boreholes, Geophysics, Analogs, Seismographs, Oscilloscopes, Rock properties, *Acoustic equipment, Drill holes, *Logging (Recording), *Subsurface investigations, Exploration, Bibliographies.
Identifiers: *Acoustic logging, Geophysical logging, Probes (Instruments), Elastic waves.

An experimental model of a type of fast response equipment for investigating physical and mechanical properties of rocks in boreholes was developed. The equipment records in analog form a maximum of information on the acoustic signals at individual points of a borehole and obtains continuous diagrams indicating the variation of the most important signal parameters along the profile. All observations are made while the probe moves at a constant rate in the borehole. The equipment has improved characteristics of the acoustic elements lowered into the borehole emitters, pickups, and acoustic insulators. Field tests showed that the equipment works reliably even in profile sections which greatly complicate the investigatons, namely in rocks characterized by low velocities and high absorption of the elastic waves. (USBR)
W71-01725

PRESTRESSED ROCK ANCHORS AND SHOTCRETE FOR LARGE UNDERGROUND POWERHOUSE,
For primary bibliographic entry see Field 08C.
W71-01735

8F. Concrete

CONCRETE PLACEMENT (SPLIT LEVEL - NO VERTICAL JOINT SCHEME),
O. R. Lunn.
Pap, Conf Rapid Constr Concr Dams, Asilomar, Calif, Mar 1970. 15 p, 5 fig.

Descriptors: *Concrete dams, *Concrete placing, Concrete construction, Mass concrete, Temperature control, Dam construction, Dams, Construction costs, Monoliths, Construction joints, Construction, Cooling, Vertical joints, *Formwork (Construction), Lifts (Construction).
Identifiers: *Construction methods, Precast concrete forms, Cost savings.

A method of constructing concrete dams using insulated, precast concrete panels as upstream and downstream forms and a concrete placing method that eliminates vertical joints is presented. Technical and construction advantages of using the precast concrete forms are tabulated. The concrete placing method consists of placement of 65-ft-wide blocks or monoliths in 5-ft lifts with overlapping edges. To minimize the slope area of the overlapping edges, a split-level concept is used, consisting of placing alternate blocks and keeping the difference of top elevation of adjacent blocks at one-half lift height. Pipe cooling is provided for temperature control. The method allows an almost level surface throughout construction, making the top of the dam a safer place to work; concrete placement is easier and can be expected to result in more consistent quality; all formwork on top of the dam consists of placing precast panels; and continuous placing of concrete by belt conveyors is more feasible. Estimated savings using the method is one dollar per cu yd of concrete for large dams. (USBR)
W71-01723

THE CLYWEDOG RESERVOIR PROJECT,
Halcrow (William) And Partners, London (England).
For primary bibliographic entry see Field 08A.
W71-01738

8G. Materials

DETRIMENTAL EFFECTS OF NATURAL SOIL AND WATER ELEMENTS ON DRAINAGE PIPE STRUCTURES IN ALABAMA,
Geological Survey, Tuscaloosa, Ala. Water Resources Div.
For primary bibliographic entry see Field 08B.
W71-01676

TECHNOLOGY OF CONSTRUCTING CANALS WITH POLYMER MEMBRANE LININGS,
V. V. Zherebtsov, T. A. Chapurskaia, and V. I. Romashkevich.
Transl from Russ, Bur Reclam Transl 840, July 1970. 30 p, 5 fig, 4 tab, disc. Gidrotekh melior, No 6, p 17-25, 1969, and No 2, p 23-24, 1970.

Descriptors: *Canal design, Earth handling equipment, Lower cost canal linings, *Excavation, *Foreign construction, *Buried membranes, Canals, *Canal linings, Impervious membranes, Trenches, Comparative costs, Canal embankments, Polymers, Mechanization, Soil compaction, Polyethylenes, Costs, *Canal construction, Construction materials, Construction.
Identifiers: USSR, *Construction methods, Seepage control, Protective coverings, Plastic film.

With the objective of maximum mechanization, construction technology for placing polyethylene membrane linings in canals has been developed in the USSR. The trench and the perimeter methods were developed for canals in thorough and partial cuts for cohesive, nonsettling soils having high seepage coefficients. The perimeter method can also be used in rocky soils by constructing a layer of fine-grained soil on which to place the membrane. Both methods are described, including sequence of operations and construction equipment. Basic operations for the trench method are: (1) excavate the trench for membrane placement, (2) place the membrane, (3) backfill the trench, and (4) excavate the canal cross section. Basic operations for the perimeter method are: (1) excavate the canal cross section, (2) place the membrane, and (3) place the earth cover. Canal construction in several standard sizes was studied for the methods. Construction output per man-day was about the same as mechanized construction of monolithic concrete linings. Excluding earthwork costs, monolithic concrete lings cost 1.5 to 3 times more than polyethylene membrane linings. A discussion is included suggesting that earthwork costs could be cut in half and hand trimming eliminated by using rotary screw excavators. (USBR)
W71-01739

A TRACER STUDY OF PRESCALING DEPOSITION OF SCALE FORMING COMPOUNDS ON CONTROLLED SURFACES,
North American Rockwell Corp., Canoga Park, Calif. Atomics International Div.
Howard L. Recht.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402. Price $0.40. Office of Saline Water Research and Development Progress Report No. 521.

Descriptors: *Scaling, *Calcium Sulfate, *Radioactivity, *Heat Exchangers, Tracers, Desalination, Distillation, Scaling, Corrosion.
Identifiers: Autoradiography, Nucleation, Induction, Radioactive Calcium.

The chemistry and physics were studied of the induction period in the heterogeneous nucleation of heat-exchanger scale to elucidate the mechanism and energetics of the surface influenced processes which are occurring, Solutions of calcium sulfate tagged with radioactive calcium-45 were placed in contact with metal wafers which served as models for heat exchanger surfaces. The level of surface radioactivity after rinsing was related to the amount of calcium sulfate adsorbed on the metal surface. The amounts so adsorbed, at concentration levels below that of bulk deposition can be measured quantitatively. Experiments conducted over a range of solution concentrations, temperatures, and exposure periods yielded adsorption isotherms and adsorption rates. Adsorption studies were conducted on copper and on 90-10 Copper-Nickel alloy. Surfaces were prepared by grinding, polishing, ultrasonic cleaning and thermal etching in the temperature range 125 to 225 F. (Fillian-OSW)
W71-01748

8H. Rapid Excavation

HIGH-PRESSURE WATER JETS FOR UNDERSEA ROCK EXCAVATION,
Exotech Inc., Rockville, Md.
W. C. Cooley, and L. L. Clipp.
Trans Amer Soc Mech Eng, J Eng Ind, Vol 92, Ser B, No 2, p 281-287, May 1970. 7 p, 14 fig.

Descriptors: *High pressure, *Jets, *Rock excavation, Tunneling, *Underwater excavation, Research and development, Fragmentation, Mining, Kinetic energy, Overbreak, Shock waves, Penetration.
Identifiers: *Jet piercing, Rock breakage, Pulsating jets, Wear, Tooling, Rapid excavation, Undersea aqueduct (Collective).

Research on pulsed high-pressure water jets in their application to breaking rock is reviewed. Experiments show the input energy per unit volume required to fracture various types of rock as a function of the pertinent variables. The stagnation pressure of the liquid jets was varied from 50,000 to 5 million psi. Theories of jet penetration through water and air are compared with experimental results. The feasibility and potential advantages of using pulsed water jet equipment for ocean-floor excavation are discussed. Conclusions are that pulsed water cannons offer a promising potential for remote-controlled or manually controlled underwater excavation. The operating jet pressure should be optimum for the type of rock being excavated. Much research and development is needed to optimize a complete underwater excavation system. Potential advantages of continuous remote-control-led operation, flexibility of operation, and absence of tools that wear out make the system attractive for further investigation. (USBR)
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A. Center of Competence		
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University of Texas - Waste Water Treatment and Management	W71-01756--01769 01838--01845 01847--01858 01966--01986	55
University of Chicago - Metropolitan Water Resources Management	W71-02111--02113 02115--02117 02120--02123 02134--02141 02143--02158	34
Iowa State University - Agricultural Livestock Wastes	W71-01992--02011 02013--02037 02040--02045 02047--02050	55
Cornell University - Policy Models for Water Resources Systems	W71-02079--02083 02085, 02088 02090--02091 02095--02096	11
Vanderbilt University - Thermal Pollution	W71-02055--02057 02059--02064 02066--02071 02073--02076	19
Bureau of Reclamation - Engineering Works	W71-01721--01723 01725--01732 01734--01743	21
University of Arizona - Arid Lands Water Resources	W71-01701--01720 01651, 01653 01654	23
Rutgers University - Water Resources Economics	W71-02101--02110 01750, 02099	12
University of Washington - Water Quality Requirements for Aquatic Organisms	W71-01859--01860 01862--01869	10

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A. Center of Competence (Cont'd)		
University of Florida - Eastern U.S. Water Law	W71-02159--02200 02124--02133 01655, 01661 01667, 01677 01682, 01685 01691, 01724 01733, 01744 01745, 01751 01753, 01770 01811, 01846 01861, 01871 01873, 01874 01876, 01886 01913, 01924 01928, 01949 01953, 01958 01963, 01965 02012, 02038 02039, 02046 02058, 02065 02072, 02077 02078, 02084 02086, 02087 02089, 02100 02092--02094 02097, 02098 02114, 02118 02119, 02142	105
B. State Water Resources Research Institutes		
Louisiana Water Resources Research Institute	W71-01652	1
Minnesota Water Resources Research Center	W71-01656	1
Washington Water Research Center	W71-01657	1
Kentucky Water Resources Institute	W71-01660 01892--01894	4
North Carolina Water Resources Research Institute	W71-01888, 01890 01891, 01897	4
Kansas Water Resources Research Institute	W71-01889	1
Georgia Environmental Resources Center	W71-01895	1
Wisconsin Water Resources Center	W71-01896	1
Massachusetts Water Resources Research Center	W71-01897	1
Connecticut Institute for Water Resources	W71-01899	1
Rhode Island Water Resources Center	W71-01900--01901	2
C. Others		
Environmental Protection Agency	W71-01658--01659	2
Office of Saline Water	W71-01746--01749 01870, 01752	6
Office of Water Resources Research	W71-01837	1

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CENTERS OF COMPETENCE AND THEIR SUBJECT COVERAGE

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the EPA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

Supported by the Environmental Protection Agency in cooperation with WRSIC.

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.
- Agricultural Livestock Wastes at the Department of Agricultural Engineering of Iowa State University.

Subject Fields

1 NATURE OF WATER

2 WATER CYCLE

3 WATER SUPPLY AUGMENTATION AND CONSERVATION

4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

6 WATER RESOURCES PLANNING

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